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PAST PRESIDENTS OF THE AMERICAN PEDIATRIC SOCIETY 1888-1938

PRESIDENT'S ADDRESS

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BOSTON

Half a century after its inception, the American Pediatric Society faces today a world of ever increasing complexity. Science and skills, even social thinking, move rapidly into new areas. Daily new intricacies are found in the national economy and in world affairs. There are new machines, new habits, new relationships and new perplexities. Yet in what seems incessant change—sometimes at startling tempo—our society, I believe, has matched the vigor and the scope of progress. We have extended our function from the bedside to the hospital, through the laboratory and on into the broad field of child welfare. These have been great changes. We shall see more, many more, and greater changes.

That the society will maintain its validity, its integrity and its growth through the next fifty years none need doubt. For fifty years we have followed strong, devoted and inspired leadership. It is my purpose in this address to review this leadership, to take stock of our present and to offer, at the customary hazard, some forecast of things to come. If I seem to omit worthy names, please charge it, not to ignorance or to disregard, but to no more than a reluctance to vie with old Homer and the sheer bulk of his catalog of ships. A half-hour is scant enough for my needs as I portray the influence of the past presidents of the American Pediatric Society; so bear with me and believe that I strive for full measure, although the clock orders me to be frugal.

The American Pediatric Society developed as the result of a discussion following the adjournment of the Pediatric Section of the Ninth International Medical Congress on Sept. 7, 1887. The instigators of the idea were Job Lewis Smith, of New York; W. D. Booker, of Baltimore; I. N. Love, of St. Louis; W. P. Watson, of Jersey City,

Read at the meeting of the American Pediatric Society, Great Barrington, Mass., May 5, 1938.

N. J., and a few other members of the section. Job Lewis Smith was made temporary chairman and W. D. Booker temporary secretary. They were instructed to secure the cooperation of physicians who had shown a special interest in the study of diseases of children and to appoint a council of five. These, working with the chairman and the secretary and taking such steps as they saw fit, were to organize a permanent society.

These plans having been carried out, the American Pediatric Society met for permanent organization in the parlor of the Arlington Hotel, Washington, D. C., on Sept. 18, 1888. In the absence of Job Lewis Smith, Abraham Jacobi was elected temporary chairman; W. D. Booker acted again as temporary secretary. Jacobi, Booker and Watson comprised the committee appointed to draft a constitution and by-laws; they were to report at noon the same day. The records show that it took two hours or even less to draw up the rules which have dominated the actions of the society in the intervening years.

From the days of its birth to its semicentennial year, our society has been under the guiding spirit of outstanding practitioners, teachers, and investigators in medical and social science. It is difficult to single out the achievements of each past president, as the science and the art of medicine have been changing so constantly. However, let us consider the influence of their guidance according to three eventful periods: the first ten years (1888 to 1898), the next twenty years (1898 to 1918) and the twenty years just completed (1918 to 1938).

1888 TO 1898

In the first ten year period certain men inevitably stand out. Among them are Job Lewis Smith, Abraham Jacobi and Thomas Morgan Rotch. Equally distinguished among the names of the forty-eight clinicians who responded to the first call in 1888, other familiar names readily come to mind: Booker, Keating, Holt, Osler, O'Dwyer, Blackader, Koplik, Northrup, Pepper, Adams and many more as well. To the eminent pioneer members who are with us today, Dorning, Carr and Chapin, we are particularly pleased to be able to express our good wishes.

At the first meeting of the society, in 1889, Abraham Jacobi, then president, said: "Gentlemen—progress and success, in order to be complete and unmistakable, require centralization of means and cooperation of men." Then, in order to establish the claims of pediatrics as a division of medicine, he clearly pointed out a number of reasons on which such a consideration could be based. All the points which he made, have, as the years have progressed, been accepted as defining the scope of American pediatrics. He said: "Pediatrics deals with the entire organism at the very period which presents the most interesting features to the students of biology and medicine. . . . The surgery of infancy and childhood is also peculiar, as it is so exclusively adapted

to or necessitated by surgical diseases of the young. . . . The connection of pediatrics with neurology is very intimate indeed. . . . Likewise neurology's sister, psychology, is indebted for much of its wealth to the study of the intellectual life of infancy and childhood. . . . Psychiatry too has learned from the mental aberrations occurring at an early age." He predicted that nutrition would always be a subject worthy of watchful research. To Jacobi the schools appeared to be organized to produce nearsightedness and both physical and mental exhaustion. He believed that if we Americans would but concentrate our means in fighting preventable diseases and death as Europeans concentrate theirs in preparing for and carrying on wars, we could save as many hundred thousand as they kill. In conclusion this Nestor of American pediatrics emphasized the fact that every physician is in a sense a public being, since questions of public hygiene and medicine are both professional and social. These prophetic sayings established the claims for pediatrics and painted a bright picture of the opportunities in this field, outlining the responsibility of the American Pediatric Society for their fulfilment.

Jacobi, who filled the presidential chair a second time in 1906, was born in Hartum, Westfalen; he graduated from Bonn in 1851, submitting a Latin dissertation. The following two years he was held prisoner in German fortresses at Cologne and Minden because of revolutionary activities and lèse majesté. Escaping, he came to Boston about 1853, and from that city proceeded to New York. Eighty-three years later American pediatricians honored this man, who exercised so profound an influence on American pediatrics, by erecting a permanent monument in the Abraham Jacobi–Carl Schurz Park at Bolton Landing, N. Y. In the words of President Fox of Union University: "This park is a monument more suitable and lasting than bronze and stone—for here little children will romp their way to gladness. Symbolic of health and happiness, they will be permanent monuments to a man who gave a great career to save the lives of little children."

Job Lewis Smith, who was among the first to call the physicians together to form the American Pediatric Society, became the second president, in 1890. He fitted himself for his work by study, not alone at the bedside but in the postmortem room. While he was one of the first to devote the major part of his practice to pediatrics, he was also a general practitioner, realizing that only thus could he do his best in his specialty. He would spend hours at the sick bed of an infant in a tenement house while wealthy patients were clamoring at his door. The poor looked on him as the "good doctor." His classic contribution on the diseases of children,[1] which passed through eight editions, was the

1. Smith, J. L.: A Treatise on the Diseases of Infancy and Childhood, Philadelphia, H. C. Lea, 1869.

mainstay of the general practitioner. Through clear concise lectures his stimulating influence on his pupils was deep and lasting. It has been remarked that "had it not been for Jacobi, who outshone him by his impress on American pediatrics, Smith most likely would have been known as the father of American pediatrics."

The father of pediatrics in Massachusetts and in the rest of New England was Thomas Morgan Rotch, president of the society in 1891. He, together with Job Lewis Smith, Abraham Jacobi and L. Emmett Holt, was among the first of the founders to hold the rank of professor of pediatrics. He is to be remembered not alone for having established the percentage method of infant feeding, but for his activities in all fields which, as he saw them, stood for the best interests of infants and children. As his percentage method of feeding ebbed, his attention was focused on the development of facilities whereby clean milk could be dispensed, according to the doctor's prescription, instead of the worst possible article for the highest price. This resulted in the establishment in Boston of the first milk laboratory.

Among the many contributions of Rotch I should refer especially to his textbook on pediatrics,[2] in which he stressed the importance of acquiring knowledge regarding the normal child. I should also mention his establishment of the first hospital in this country which restricted its patients to those under 2 years of age. The ideals for which he stood should serve to stimulate us in the coming years to fulfill the broad obligations which come with membership in this society.

The perennial question of specialism bobbed up in the address delivered by William Osler in 1892. As he said: "It is almost unnecessary to mention that the public in which we live and move has not been slow to recognize the advantage in a division of labor. How comforting to the general practitioner is the wise counsel of the specialist. We take to him a case which he labels in a few minutes, as a coleopterist would a beetle, and we feel grateful for the diagnosis and happy in the possession of the label." He continued with words on which there is need to ponder even in this time, saying: "The rapid increase in knowledge has made concentration in work a necessity. Specialism is here and here to stay. Let the younger of my hearers take this to heart. In the cultivation of a specialty as an art there is a tendency to develop a narrow and pedantic spirit. Scan the lives of, say, twenty of the men most prominent in special lines of medicine and surgery today. With scarcely an exception their early lives were devoted to anatomy, physiology or pathology."

In speaking of Keating, the sixth president (1894), it should be mentioned that with the publication of his cyclopedia of the diseases of

2. Rotch, T. M.: Pediatrics: The Hygienic and Medical Treatment of Children, Philadelphia, J. B. Lippincott & Co., 1896.

children[3] pediatrics received an impulse that carried this branch of medical science to a still higher position and brought well merited recognition to those pioneers Abraham Jacobi and Job Lewis Smith. It is fitting that Keating's name should be honored with theirs. He died at the age of 41 years, a true martyr to his profession.

Among the original contributions which were made by presidents of the American Pediatric Society during the first ten years of its existence, mention should be made of the invention of the intubation tube by Joseph O'Dwyer, our eighth president (1896). In the years before the use of antiserum, 40 to 50 per cent of the small patients who contracted diphtheria were doomed. O'Dwyer, ingenious, reflective, a lover of children, began to ponder on the situation. The first mention of the tube occurs in a recorded history in the "dead book" of the New York Foundling Hospital, April 25, 1884. It was a great disappointment to O'Dwyer that many authorities on children's diseases felt that his invention was of little service. Little by little it was seen to be of advantage in treating patients with laryngeal diphtheria, and it was also used for patients with other stenotic diseases of the larynx. It was characteristic of the real philanthropist that O'Dwyer turned with equal eagerness to study and to use antitoxin as soon as it was introduced. Dr. Northrup has said that "in the maternity service he was the expert obstetrician, in intubation an inventor and teacher, in general medical service the constant consulting mind whose opinion in times of clinical difficulties and troubles every one sought."

Thus, during the first ten year period discerning observations at the bedside and constant application of the newer laboratory measures for health and against disease were of great importance in advancing the purpose for which the American Pediatric Society was created. It was primarily the impetus provided by these early presidents and by their contemporary disciples that placed American pediatrics on a firm basis as an independent division of medicine.

1898 TO 1918

The second eventful period might be called the beginning of the scientific era; during these years the promotion of child welfare gained momentum.

In 1898, on the tenth anniversary of the founding of the Society, L. Emmett Holt asked the indulgence of his audience for raising a subject of vital importance to every pediatrician: the scope and limitations of hospitals for infants. Such hospitals are needed as places for research, and, being places for research, they must be equipped with

3. Keating, J. M.: Cyclopedia of the Diseases of Children, Medical and Surgical, Philadelphia, J. B. Lippincott & Co., 1889.

pathologic, bacteriologic and, if possible, chemical laboratories. Every year the government ungrudgingly spends large sums of money in the experiment stations of agricultural departments. Why should it not spend at least as much toward solving the problem of how infants may best be reared? Hospitals devoted to infants and children are needed for the teaching of physicians and medical students. Teaching hospitals are needed for the training of nurses, and, last but not least, they are needed for those infants who can be better cared for in institutions than at home.

Holt's writings, which date from 1882, cover clinical, pathologic and therapeutic subjects. In 1911 he first began to be concerned with clinical investigation and to apply the technics afforded by his association with trained workers in the bacteriologic and chemical branches of medicine. Later in life he became interested in the protection of well children from disease. Holt was twice made president of the American Pediatric Society—in 1898 and again in 1923.

In his second address he prophesied: "In the years to come there will be three distinct types of pediatrist—first, the research man, who is likely to be a full-time head of a department of pediatrics in our university medical school; second, the man who applies our best science in the treatment of sick children; third, the public health pediatrist. It is impossible to say that any one of these is the most important, for all seem to me to be equally essential." Then he emphasized health teaching as a large part of the duty of the physician, and especially of the pediatrician of the future. He added: "Comparatively few of us have had the training or the opportunity or the resources for profitable scientific research. Every day it becomes more difficult to be properly fitted for such work, but all of us can have a share and a large one in the general campaign of education which must form the basis of great achievement in the field of preventive medicine."

Holt was one of those who were largely responsible for the progressive trend of pediatrics from the early, almost purely clinical form to its modern, more scientific phase. Holt and his distinguished pupil Howland, co-authors of a textbook,[4] died within two years of each other: Holt in 1924, in his sixty-ninth year, and Howland in 1926, at the age of 53, when he was in his period of greatest productivity and influence.

Others of the presidents in this eventful period may be mentioned for their clinical and scientific acumen. Northrup (1899), always one of the enlivening spirits of the society, advocated strongly in his address the open air treatment of pneumonia in roof wards and roof gardens

4. Holt, L. E., and Howland, J.: The Diseases of Infancy and Childhood, ed. 6, New York, D. Appleton and Company, 1911.

of private hospitals. Koplik (1900) will always be known for his observations on the spots which bear his name. Booker (1901), an important figure in the society's organization, was one of the earliest students of the intestinal flora associated with diarrhea. Christopher (1902), interested in obscure problems of nutrition, was foremost in establishing medical inspection of school children and organized a child study department. Rachford (1907), an able physiologist, made a classic contribution in his early work on the pancreatic enzymes. He is to be remembered also because, during his later career as a general physician and pediatrician, he tied up the Babies' Milk Fund of Cincinnati with the Department of Pediatrics of Cincinnati Medical College and established, through the generosity of one of his patients, the full time chair of pediatrics there.

Thus it may be said that within the span of the twenty years from 1898 to 1918 two definite forward steps were taken. The two motifs, that is to say, medical science and medical sociology, are intertwined throughout the twenty years which bring us to the present day.

1918 TO 1938

In turning to the twenty year period just completed it is pertinent to quote the remark made by Pasteur: "Chance favors those minds prepared in the fields of observation." He uttered these words in 1854, when insisting that pure science is important even though the resulting discoveries may have no immediate application. Chance favored the prepared mind of John Howland, and his observations on the diseases of children have left an indelible mark on scientific progress. Led by his enthusiasm for science, his ability as a clinician, his influence as a teacher and his wisdom as a counselor and friend, the forward march continued which has placed American pediatrics in the high position it occupies today.

Howland became president of this Society in 1921, ten years after he had accepted this position of leadership in pediatrics at Johns Hopkins Medical School. In his address he directed attention to prolonged intolerance to carbohydrates; the problem especially intrigued him, and he wished to stimulate interest in a matter on which the available knowledge was scant.

In his early days, when pediatrics was a purely clinical subject, Howland ignored tradition; as a clinical investigator, he made discoveries which had immediate application. Almost from the beginning of his career he turned to physiology; he was the first in this country to measure the energy metabolism of sleeping children. During his studies with Czerny, the theory of acidosis in intestinal intoxication was advanced, and soon afterward, in his early years in Baltimore, he proved this theory to be true.

The development of the full time clinic in the Harriet Lane Home at Johns Hopkins Hospital was considered by Howland to be his greatest accomplishment. In the fourteen years of his leadership he saw it grow to be the foremost department of pediatrics in this country. His pupils were inspired with a devotion to duty and with an enthusiasm for scientific investigation, and Howland's assistants were in constant demand to fill like positions of responsibility elsewhere.

Of our presidents who have followed Howland, several have attained distinction in special fields. Ruhrah (1925) will long be remembered by most of us for his scholarly and entertaining delving into pediatric history. Schloss (1933) was an early and particularly able student of the phenomena of allergy, and the important investigations of Talbot (1936) have furnished the ground work for studies of basal metabolism in early childhood. Brennemann, although he did not become president until 1930, had long been distinguished as a clinician and known as well for his early and important work in modification of milk. Fife (1934) deserves especial mention as one of the wisest and most widely beloved practitioners of the art of pediatrics in our time.

I have said that I cannot vie with Homer's catalog of ships. Probably no one was ever chosen to be president of this society without sufficient reason in his professional attainments. If I have failed to mention and consider the career of each and every one I am sure that you will appreciate my limitations.

CHILD WELFARE

Consider now another aspect of our progress, which had its beginnings early in the century but has proceeded with constantly increasing acceleration during this latest period. Today the rapid, widespread growth of the movement for maternal and child welfare and its vital relation to modern pediatrics are matters of common knowledge. It is interesting to look back over the period which followed its initiation and see to what extent the presidents of this society, all leaders in pediatric thought, have stimulated and contributed to the progress of the movement.

In 1904 Caille said: "The time has arrived when the weight and authority of our society in addition to being felt by our professional colleagues should be made to extend to the millions of homes throughout the land." Jennings, a year later, reiterated: "The society is ready to assume broader obligations and to grapple with larger problems. The society may and should be ready with its . . . knowledge of child responsibilities to unite with national (state and public) organizations for the improvement of the . . . well being of children." Such statements were endorsed and amplified by succeeding presidents. Kerley (1908) took cognizance of the problem and pointed out the importance of the pediatrician in its solution. Rotch, a pioneer in this field, in an

address in 1909 stressed the duty of the society, remarking: "We should make ourselves felt in the light of an advisory body." A lively discussion by men who in subsequent years became president followed this address. La Fetra (1918) favored the society's undertaking plans for the safeguarding of child life; Adams (1897), for twenty-five years the beloved secretary of the society, believed it was time for the society to take some part in national affairs. Among those who were against the idea of enlarging the activities of the society, Carr (1912) spoke as follows: "As the churches were organized to care for spiritual well-being, we were organized to study the diseases of the child." Abt (1927), father of pediatrics in the Middle West and idolized by many of us here today, said: "It is our mission to stimulate and encourage scientific work . . . not to become entangled in political or legislative questions." Holt stated that he would feel sorry to have the society devote a large part of its time and energy to subjects which, although they are of sociologic interest, do not have any real bearing on the more strictly medical matters with which most of us are concerned. Morse (1913), a great practitioner-consultant and a wise thinker, fully agreed with these remarks.

In his address in 1910, David L. Edsall, who deserted pediatrics to become a renowned international authority in medical education, strongly advocated the participation of the society in wider fields. He felt that it should act as a center for the accumulation and dissemination of knowledge relating not only to subjects intimately associated with pediatrics but also to those of importance to the public at large.

In the transactions of the society, these were the first foreshadowings of the beginnings of an organized child health and child welfare movement. It remained for Hamill, in his address in 1914, to give forceful recognition to an advance in social medicine already definitely under way, thanks largely to himself and to some of his colleagues in the society.

He said: "I do not want for one moment to convey the impression that the American Pediatric Society should sacrifice one particle of its endeavor along lines of laboratory and clinical research. I do believe it should add to its program scientific research along lines of preventive medicine as it applies to the welfare of the child." He asked: "What after all is preventive medicine?" and he answered: "It is synonymous with public health. The maintenance of public health means practically the maintenance of the health of the child."

Hamill, contemplating the ravages of preventable diseases, was not satisfied with mere efforts to improve the treatment of the sick. Instead of merely fighting a defensive battle at the bedside, he turned to a vigorous attack against disease at its source. He extended his efforts into the field of preventive medicine and child hygiene. Education was

his chief weapon, principally education of the medical profession but also concomitant education of the lay public. He will stand always in the position of a national leader because of his notable achievements in the betterment of child health. Interestingly, in after years Carr, Morse, Abt and finally Holt joined hands with those who first rallied to the dictum issued by Abraham Jacobi in 1888: "Questions of public hygiene and medicine are both professional and social."

During the period covered by these early manifestations of interest on the part of the society, solicitude for maternal and child health and welfare was gaining strength among other interested groups besides the pediatricians. It soon became clear that the problems involved were such as could be better dealt with by organizations of broader scope, and that the part to be played by the Pediatric Society must consist chiefly of the active and influential participation of its members in these organizations. It is worth while to consider what important roles the presidents of the society have played in these developments.

Sixty years or more ago practically no child welfare work, as one understands it today, was being carried on. In fact, before 1872 there were no laws for the protection of children. The child had hardly been discovered. In 1866 the Society for the Prevention of Cruelty to Animals was established, and this society inadvertently became a protector of children as well. A mission worker in the slums of New York came upon a child who had been adopted at an early age by two disreputable persons, who were treating her with great cruelty. Being unable to get action through her own efforts, the mission worker called on the Society for the Prevention of Cruelty to Animals! The matter was taken under careful consideration and was referred to the counsel of the society, who decided that "the child being an animal" the society would act. So much attention was given to this so-called Mary Ellen case and so many demands were made for action against similar outrages that the Society for the Prevention of Cruelty to Children was established on April 27, 1875, only nine years after the formal incursion into organized efforts for animal welfare.

In 1910, stimulated largely by the accumulation of evidence from studies in the clinical field, the American Association for the Study and Prevention of Infant Mortality came into being and held its first meeting. In its membership were representatives of many other interested groups besides the pediatricians, but at that first meeting and throughout its life, among its most influential members were men who have held the presidency of this society. Knox, its first president, became president of the American Pediatric Society in 1926. He has from the beginning been one of the most active proponents of the child welfare movement. Later presidents of the Society, Shaw (1929), Carpenter (1932), Veeder (1935) and Helmholz (1937), were pioneers

in the development of activities promoting child health in their own communities. They were always leaders in the undertakings of this society and of the others with which it merged in the course of its development.

Ex-President Herbert Hoover in 1921, as head of the Child Hygiene Association, took steps to increase the effectiveness of the work being done in behalf of children. After careful consideration and stimulated by him, Josephine Baker's American Child Hygiene Association and Holt's Child Health Organization combined in 1923, under the name of the American Child Health Association.

In 1909, two or more decades after the formation of our society, the American Association for the Study and Prevention of Infant Mortality was the only organization devoted exclusively to the health of the child. In 1935 the American Child Health Association disbanded. It had so successfully completed its specific purpose, to stimulate intelligent interest in child care and welfare, that there were already dozens of organizations in the field ready to subdivide and extend the work it had been doing.

Van Ingen, president in 1931, should receive special recognition for the part he has played in these developments. In the various positions which he has held throughout the history of the organizations concerned in the welfare of the child, his has not been merely perfunctory service. In each he has played an outstanding part. If one were to review in detail the progressive steps of these several organizations, one would find that not only have his advice and counsel been influencing factors in every forward move but in many of them his has been the guiding spirit.

The fact that the welfare of children warranted serious attention and support by the federal and state governments was recognized by the formation of the Children's Bureau of the United States Department of Labor in 1912. As set forth by the act creating the bureau, its function is to investigate and report on all matters pertaining to the welfare of children among all classes of people.

In this sketch of steady progress it would be remiss not to mention the third White House conference, called by President Hoover in 1930, in which two of our presidents, Hamill and Van Ingen, played so vital a part. This conference dealt with every aspect of child life. In the report of the section on medical service was presented a most comprehensive and well considered formulation of present knowledge relating to growth and development, prenatal and maternal care, and health care for children.

We cannot ignore the significance which these trends have for the public and for the practitioner, nor can we deny what has been learned from experience of past years. It is unnecessary to review the statistical

facts as to the evils which exist. They are already known. Science has given us the weapons with which to combat an increasing number of special diseases, but mortality and morbidity continue to be high. A great gap still exists between possibilities and actual results.

Today the physician is no longer called on to minister only to the sick; more and more he is being required to keep his clients well. Preventive medicine, sanitary science and hygiene are growing in importance, and the modern physician must have some grasp of all of these phases of his calling. This demands a working knowledge of the basic fundamental sciences and of the most recent developments in these fields. Nor can the physician be indifferent to the problems of heredity, ethics and religion.

In addition to his knowledge of these fundamental branches, it is essential that the pediatrician have an understanding of the processes of growth and development which he can apply in his supervision of the child.

This study cannot be limited wholly to infancy and childhood; it embraces a wider territory, which extends from the antenatal period up to and through adolescence. It leads us into the borderline fields, those of the biologic and even the social sciences. Specialization commonly restricts; pediatrics measurably broadens.

How shall the pediatrician of the next fifty years best be trained for these wider responsibilities? Holt described three types of pediatrician—the research worker, the practitioner and the public health pediatrician. Exceptional men are needed in all these fields. Because of the rapid changes in our concepts of the special training needed and because of general changes in the character of medical education, the trend of teaching in pediatrics, for both undergraduates and graduates of the medical school, is likely to undergo great alteration. Advanced education, maintained through cooperation between the medical schools, the schools of public health and the hospitals, will be an increasing need of the pediatrician.

The distance that the past fifty years has carried us is almost incredible. It was only in 1909—less than thirty years ago—that the American Academy of Medicine, in a conference on the prevention of infant mortality, proved the enormous waste of infant life. The work of the Children's Bureau dates from 1912, when some of us were in medical school. The American Child Health Association in 1923 combined groups only a few years its senior. We are seeing what were small, even sporadic movements in their beginning gradually join and enlarge their purposes and activities. We perceive child health and welfare programs to be taking steadily a larger place in our professional sphere and in public thinking.

At the beginning of this paper, I indicated a reluctance to prophesy. I have still that reluctance. Please construe what I have to say about legislation, therefore, not as a forecast nor as hope or fear, but rather as a diagnosis. This country is confronted by a multitude of human problems and needs, which result, I believe, from trends toward urban living and great industrial concentration. Of these needs and problems, our group must regard those affecting the health and welfare of the child as paramount. To one degree or another, the American people have endeavored to alleviate need, especially among the aged and unemployed. It is not unnatural that sections 1, 2 and 3 of title V of the Social Security Act were made a part of a national program, as measures against dependency and ill health among mothers and children. None can doubt that these features of the program are permanent, and few would expect them to remain static.

I strongly recommend that the American Pediatric Society take cognizance of these significant extensions of the field of child health and welfare. To that end, I believe, the society should appoint a standing committee to advise it on projects relating to medical education and training and to child health and welfare. Such a committee might properly offer consultation also to legislators and to groups sponsoring legislation in behalf of children. It is not enough for us to keep abreast of these matters. Our knowledge, our technics and our policies must be constantly in advance of them. My own position in making this recommendation is neither advanced nor conservative. It represents, rather, an effort to be objective and practical. Medicine and medical specialization are essentially a part of organized public welfare. Let us recall Mary Ellen. People of her day—when society deigned to give a little girl some share of the protection it accorded beasts—are still alive. To have resisted these changes would have been unthinkable. To expect no further progress is folly. Let us make sure that growth in our own field is sound in its scientific and social aspects. We can do this only by participation. These times present to us a challenge as physicians and as citizens. Let us respond with leadership.

VITAMIN A, CAROTENE AND VITAMIN C CONTENT OF CANNED MILK

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Following our previous publications concerning the vitamin A and the vitamin C content of mothers' milk, cows' milk and cows' milk mixtures for infant feeding, the present paper concerns a corresponding investigation on canned milk.

From three to six samples were obtained of each variety of imported canned milk obtainable in Batavia in the retail trade and their vitamin A and vitamin C content was determined, according to the method described previously. The milk was diluted in the manner indicated on the label as adapted to infants about 3 months old.

It is not likely that in the preparation of canned milk there is any appreciable loss of vitamin A or of carotene, as heating has a destructive effect on vitamin A substances only when it is possible for oxygen to exercise its influence, which is avoided as far as possible in the process of canning milk. It is also unlikely that any considerable proportion of vitamin C is destroyed in this process, even though its oxidation at a fairly high temperature does take place more readily than in the case of vitamin A substances.

Thus it is probable that the vitamin A content of canned milk after dilution will be approximately the same as that of fresh cows' milk, with low values if the cows were confined in stalls and higher values if they were kept in the pasture. The vitamin C content of canned milk is most likely a trifle lower than that of fresh milk, according to the degree of oxidation that occurs in the process of canning.

It is theoretically possible that in the process of canning substances are occasionally formed that apparently enhance the vitamin A and the vitamin C content, if with antimony trichloride they produce a nonspecific blue tint or if they discolor in a nonspecific manner 2,6-dichlorophenolindophenol. But it is improbable that this takes place to an extent that is of any practical significance.

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This investigation was carried out with the support of the Institute for Nutrition Research at Batavia.

Theoretically, the correctness of the method applied would be determined with certainty only if one were to succeed in isolating vitamins A and C in milk and canned milk in the exact quantity which had been expected on the basis of the determinations.

TABLE 1.—*The Vitamin A, the Carotene and the Vitamin C Content, the Specific Gravity and the Fat Content of Varieties of Canned Milk*

Variety of Milk	Dilution by Weight	Fat Contents: Determinations	Fat Contents: Diluted	Fat Contents: Undiluted	Specific Gravity: Determinations	Specific Gravity: Diluted	Specific Gravity: Undiluted	Vitamin C in Mg. per 100 Cc.: Determinations	Vitamin C in Mg. per 100 Cc.: Diluted	Vitamin A in Int. Units per 100 Cc. (Diluted): Determinations	Vitamin A: Carotene	Vitamin A: Vitamin A	Vitamin A: Total
Sweetened Condensed Milk													
1	1:4	7	2.0	10.0	7	1.062	1.300	7	0.9	5	18.6	32.3	59.0
2	1:4	3	1.4	7.0	3	1.051	1.297	3	1.0	3	12.1	27.1	39.2
3	1:4	3	1.9	9.5	3	1.052	1.300	3	1.0	3	14.3	29.3	43.6
4	1:4	3	1.5	7.5	3	1.034	1.300	3	1.2	3	15.2	30.8	46.0
Evaporated Milk													
5	1:2	3	3.1	9.3	3	1.023	1.084	3	1.9	3	16.4	38.6	55.0
6	1:2	3	2.9	8.7	3	1.024	1.083	3	2.5	3	12.5	45.8	58.3
7	1:2	3	2.9	8.7	3	1.029	1.085	3	2.0	3	21.1	47.0	68.1
8	1:2	6	2.6	7.8	6	1.030	1.082	6	2.9	4	11.1	34.9	46.0
9	1:2	6	3.5	10.5	6	1.031	1.086	6	2.9	6	21.6	54.0	75.6
10	1:2	3	2.8	8.4	3	1.028	1.087	3	3.0	3	15.7	41.8	57.5
11	1:2	3	2.5	7.5	3	1.025	1.081	3	0.9	3	5.8	25.6	31.4
12	1:2	3	3.0	9.0	3	1.028	1.083	3	2.6	3	20.8	31.7	52.5
Sweetened Skimmed Milk													
13	1:4	3	0	...	3	1.056	1.345	3	0.9	3	3.0	0.6	3.6
14	1:4	3	0	...	3	1.074	1.352	3	0.7	3	3.3	1.7	5.0
15	1:4	4	0	...	4	1.075	1.350	4	0.7	4	2.8	3.7	6.5
16	1:4	3	0	...	3	1.057	1.340	3	0.9	3	3.9	3.2	7.1
17	1:4	3	0	...	3	1.059	1.355	3	0.8	3	3.2	6.4	9.6
18	1:4	3	0	...	3	1.057	1.329	3	0.9	3	2.8	14.0	16.8
Sterilized Whole Milk *													
19	...	3	...	3.6	3	.....	1.029	3	1.7	3	18.5	47.8	66.3
20	...	3	...	2.6	3	.....	1.038	3	1.9	3	5.2	18.8	24.0
21	...	3	...	3.3	3	.....	1.033	3	1.7	3	14.0	20.3	34.3
Milk Powder, Unsweetened													
22	1:7.4	3	3.6	30.3	2	1.030	.....	3	1.25	3	23.2	38.1	61.3
Milk Powder, Sweetened													
23	1:7	4	2.5	20.1	4	1.038	.....	4	0.75	4	9.2	19.2	28.4
24	1:11.2	3	1.8	22.0	3	1.031	.....	3	1.6	3	19.9	27.1	47.0
25	1:5.6	3	3.0	19.6	3	1.044	.....	3	0.8	3	4.1	5.8	9.9
Lactic Acid Milk in Form of Powder													
26	1:5	3	3.1	18.6	3	1.051	.....	3	0.8	3	38.8	45.4	84.2
27	1:7	3	3.4	27.2	3	1.031	.....	3	1.3	3	6.2	27.4	33.6
28	1:6.4	3	3.8	28.1	3	1.035	.....	3	1.3	3	21.2	50.2	71.4
Buttermilk													
29†	1:1.5	3	0.5	1.25	3	1.049	.....	3	1.2	3	3.2	3.8	7.0
30‡	1:5	4	1.2	7.2	4	1.054	.....	4	0.9	3	4.7	24.1	28.8
Protein Milk, Evaporated													
31	1:1	31	2.3	4.6	..	.....	.....	17	0.6	28	16.1	51.2	67.3

* Undiluted. † Evaporated. ‡ Powdered.

Besides the vitamin A, the carotene and the vitamin C content, the specific gravity and the fat content were determined. Table 1 presents a survey of the results.

As regards the vitamin C content of the canned milk examined after dilution, one may arrive, on the basis of this table, at the following conclusions:

1. Sterilized whole milk contains as much vitamin C as fresh milk (about 1.8 mg. per hundred cubic centimeters). 2. Evaporated unsweetened condensed milk contains as much or more vitamin C than does prepared fresh milk, namely, from 2 to 3 and from 1.5 to 2 mg. per hundred cubic centimeters, respectively, which may have something to do with the method of preparation (one of the eight preparations examined has a lower content). 3. Milk powder and sweetened condensed milk have a vitamin C content of from 0.8 to 1.6 mg. per hundred cubic centimeters, or on an average more than one half of the content of mixtures prepared from fresh cows' milk (1.5 to 2 mg.). 4. Sweetened skimmed milk contains about 0.8 mg. of vitamin C per hundred cubic centimeters, which is less than one-half the content of prepared fresh milk. 5. The vitamin C content of buttermilk and of lactic acid milk (the former either evaporated or in the form of powder and the latter only in the form of powder) averages about 1 mg. per hundred cubic centimeters, it being therefore as low as that of the corresponding mixtures prepared from fresh milk (Meulemans and de Haas, 1937 [1c]). The evaporated protein milk preparation examined contained 0.6 mg. of vitamin C per hundred cubic centimeters after dilution.

Except the evaporated (unsweetened condensed) milk, the varieties of canned milk examined, therefore, contain as much or a little less vitamin C (from 0.5 to 2 mg. per hundred cubic centimeters) than does fresh cows' milk (from 1.5 to 2 mg.). The infant feedings made of fresh milk, however, also contain about 1 mg. of vitamin C (Meulemans and de Haas, 1937 [1c]). The vitamin C content of the varieties of canned milk, therefore, practically equals that of the preparations of fresh milk.

It must be emphasized, however, that cows' milk contains much less vitamin C than does mothers' milk (about 2 mg. and from 4 to 7 mg., respectively). Thus preparations made from fresh milk, as well as the canned milk products, have a much lower vitamin C content than

1. (*a*) de Haas, J. H., and Meulemans, O.: The Ascorbic Acid (Vitamin C) Content of Mother's Milk at Batavia, Indian J. Pediat. **3**:216-233, 1936. (*b*) Meulemans, O., and de Haas, J. H.: The Carotene and Vitamin A Contents of Mother's Milk at Batavia, ibid. **3**:57-75 and 133-145, 1936; (*c*) The Vitamin C Content of Cows' Milk and of Cows' Milk Mixtures (A Contribution to the Vitamin C Prophylaxis), ibid. **4**:1-10, 1937. (*d*) de Haas, J. H., and Meulemans, O.: The Carotene and Vitamin A Contents of Cows' Milk and of Cows' Milk Mixtures (A Contribution to the Vitamin A Prophylaxis), Ztschr. f. Vitaminforsch. **7**:1-10, 1938; (*e*) Use of Canned Milk in the Netherland Indies, Mededeel. v. d. dienst d. volksgezondh. in Nederl.-Indië **26**:48-59, 1937.

has mothers' milk (about 1 mg. and from 4 to 7 mg., respectively), so that if the infant is fed with any canned milk preparation or with a mixture containing fresh milk, vitamin C must be supplemented, by means of orange juice or synthetic ascorbic acid, by about 30 mg. of ascorbic acid per day.

It is difficult to compare the vitamin C values here found for canned milk with the few data available in the literature.

In 1929 and 1930 Donath [2] tested the significance of vitamins in milk by means of animal experiments. He found that the products then on the market had lost in preparation part of the antiscorbutic vitamin which is present in fresh milk.

In the important, though somewhat obsolete, report of Schlemmer, Bleyer and Cahnmann (1932) [3] data were given concerning the vitamin C content of canned milk; but since it was later found that the method was somewhat inaccurate (no hydrosulfuric acid was passed through, and in titration the p_H had been taken too high), the values found by them cannot well be compared with ours, although the titration was already being effected with 2,6-dichlorophenolindophenol.

In 1935 Renner [4] reverted to this publication of Schlemmer, applying the identical (incomplete) method. The partial correspondence of Renner's values with ours, therefore, must be regarded as accidental.

Wieland (1936) [5] in a recent publication referred to Schlemmer and to Renner (who had recovered from the special milk preparations one-half as much vitamin C as they had been able to discover in whole milk) in order to explain the fact that an infant fed with powdered skimmed milk not only suffered from xerophthalmia but was scorbutic.

A synopsis of the older literature, which referred chiefly to animal experiments in which the vitamin C content of condensed milk had not been determined quantitatively, is to be found in the report of Neuweiler (1936).[6]

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2. Donath, W. F.: The Nutritive Value of Tinmilk and Milkpowder, Mededeel. v. d. dienst d. volksgezondh. in Nederl.-Indië **18**:247-303, 1929; De voedingswaarde van blikkemelk; onderzoek naar het gehalte van anti-xerophthalmio, anti-beri-beri en anti-scorbuut-vitamine, Geneesk. tijdschr. v. Nederl.-Indië **70**:129-139, 1930.

3. Schlemmer, F.; Bleyer, B., and Cahnmann, H.: Studien über biochemische Aktivatoren der Milch: I. Die Beziehungen zwischen dem Reduktionsvermögen der Milch und ihrem Gehalt an Vitamin C; die Auswertung der Milch auf Vitamin C nach chemischer Methode, Biochem. Ztschr. **254**:187-207, 1932.

4. Renner, L.: Vitamin-C-Gehalt von Milchpulvern, Ztschr. f. Kinderh. **57**: 414-418, 1935.

5. Wieland, E.: Ueber Polyavitaminose beim Säugling nach Ernährung mit fettfreier Trockenmilch, Schweiz. med. Wchnschr. **66**:826-848 (Aug. 29) 1936.

6. Neuweiler, W.: Die Vitamine der Milch unter besonderer Berücksichtigung der Frauenmilch, Berne, Switzerland, Huber, 1936.

In the literature few data are to be found concerning the vitamin A and the carotene content of canned milk.

In the publications just cited, Donath [2] had already pointed out that "through the various processes to which the milk is submitted in order to make it fit for conserving, the vitamin A content in most cases is but slightly impaired."

The publication of De Caro and Speier mentioned by Neuweiler was not at hand, nor was that of Jephcott and Bachrach, in which it was pointed out that canned milk as a source of vitamin equals fresh milk.

Neuweiler did not give more exact data on these subjects.

As just pointed out, it may be expected that the carotene and the vitamin A content of the varieties of preserved milk about equal those of the corresponding products made from fresh milk in Europe, whether it is stall milk (with low vitamin A values) or pasture milk (with higher values). If canned milk were to be prepared in the Netherland East Indies—which hitherto has not been done—the values probably would be somewhat higher, as in the tropics there is no occasion, as a rule, for production of stall milk.

The factor for converting the Lovibond unit blue (Wolff) into the international unit, which hitherto had been taken to be 4.2, is 6.4, according to a subsequent publication from the Hygiene Laboratory at Utrecht (van Eekelen, Emmerie and Wolff, 1937 [7]), so that the values found merely seem to be higher than was indicated in our previous publications, while actually they are not.

Since the method followed was the one described in reports on mothers' milk and cows' milk, the total content of carotenoids was determined; this is indicated in table 1. Of this, about 10 per cent proceeds from xanthophyll, which in the form of provitamin A is inactive. It has not been determined in what proportions the remaining 90 per cent of α, β and γ carotene occur, although this would have been possible through chromatographic analysis. Theoretically this information would undoubtedly be of importance, but for the purpose here intended—the comparison of canned milk as a source of vitamin A with mothers' milk —it would be of little practical value.

To take as an example an unprocessed product, fresh cows' milk: The carotene content of this substance (after 10 per cent has been deducted for xanthophyll) is 18 micrograms of daucus carotene, or 18 international units; $\frac{10}{6} \times 18 = 30$ international units per hundred cubic centimeters, the amount which would be present if all carotene were β carotene; the amount would be 15 international units per hundred

7. van Eekelen; Emmerie, A., and Wolff, L. K.: Ueber die Diagnostik der Hypovitaminosen A und C durch die Bestimmung dieser Vitamine im Blut, Ztschr. f. Vitaminforsch. **6**:159-162, 1937.

cubic centimeters if all carotene were of α or γ type, or, together with the vitamin A content, 83 and 68 international units, respectively, per hundred cubic centimeters. That is to say, in either case the amount is of the same order of magnitude, regardless of the previously found experimental error of from 10 to 15 per cent inherent in the method applied.

It is not probable that one of these extremes corresponds to the actual facts; but even if such were the case, then the content of vitamin A substances in cows' milk, after it has been prepared as infant food, would be so much less than the content in mothers' milk that in feeding prepared food it would always be necessary to add vitamin A and/or carotene in quantities that would make it unnecessary to take into account the minor difference in the carotene extremes.

TABLE 2.—*Vitamin A, Carotene and Vitamin C Content of Mothers' Milk, Cows' Milk, and Preparations of Fresh and Canned Milk*

Variety of Milk	Vitamin C Mg. per 100 Cc.	International Units per 100 Cc.		
		Carotene*	Vitamin A†	Total
Mothers' milk (Batavia)				
Colostrum	About 7.0	40-65	170-230	210-295
Late milk				
Native and Chinese women	4.0	15	55-65	70-80
European women	4.0	About 28	About 152	About 180
Cows' milk				
Stallmilk (Utrecht)	2.1	8	21	29
Pasture milk				
Before distribution (Utrecht)	2.1	25	52	77
After distribution (Batavia)	1.5	20	53	73
Preparations of fresh milk				
Two-thirds milk (Batavia)	About 1.0	13	44	57
Lactic acid milk (Batavia)	1.2	18	50	68
Buttermilk (Batavia)	About 1.0	9	21	30
Canned milk (after dilution) (examined at Batavia)				
Milk powder	0.8-1.6	4-20	6-40	10-60
Sweetened condensed milk	About 1.0	10-20	25-30	35-50
Evaporated milk	2.0-3.0	10-20	30-55	40-75
Sterilized whole milk	About 1-8	5-20	15-45	20-65
Sweetened skimmed milk	About 1.0	2.5-4	1-15	3.5-20
Protein milk (evaporated)	About 0.5	15	50	65
Buttermilk (in powder form or evaporated)	About 1.0	3-5	9-30	12-35
Lactic acid milk (in powder form)	About 1-0	6-40	25-50	30-90

* Not having subtracted approximately 10 per cent of xanthophyll. One microgram of carotene is taken to be 1 microgram of daucus carotene, or 1 international unit.
† One Lovibond unit blue (L. U. B. Wolff) = 6.4 international units.

As regards the content of A substances (carotene and vitamin A) of the preserved milk (all varieties being examined after dilution) table 1 allows the following conclusions to be drawn:

1. Milk powder, sweetened condensed, evaporated, and sterilized canned milk (leaving unconsidered one preparation of milk powder with low values) have a carotene and a vitamin A content lying between those of stall milk and pasture milk in Europe, namely, between 10 and 25 micrograms and between 20 and 55 international units per hundred cubic centimeters of diluted milk, which corresponds to what had been expected.

2. Sweetened skimmed milk contains practically no vitamin A substances, which is in agreement with the fact that this milk is fatless. This food, therefore, is ideal for producing in bottle-fed infants a vitamin A deficiency and, ultimately, xerophthalmia, as has been pointed out before (de Haas and Meulemans, 1937 [8]).

Clinical observation teaches us that this deficiency is not by any means rare. The impermissibility of the distribution of this product for infant feeding has been referred to in a preceding publication (de Haas and Meulemans, 1937 [1d]).

3. Canned buttermilk contains as few vitamin A substances as does fresh buttermilk, the small amount corresponding to the low fat content; condensed protein milk contains a fair amount of A substances, and the powder of lactic acid milk obviously contains the amount of carotene and vitamin A to be found in fresh stall or pasture milk.

Table 2 presents a recapitulation of the determinations made by us in the course of the past three years of the vitamin A, the carotene and the vitamin C content of mothers' milk, cows' milk, cows' milk mixtures and various kinds of canned milk. It is hoped that these values will be of practical significance, more especially in the diet of infants. The significance of this table may be summarized as follows:

If the bottle-fed infant is to be supplied with the amounts of vitamins A and C that are absorbed by the breast-fed infant, then to all prepared milk, whether fresh or canned, should be added both vitamin A and vitamin C, a prophylactic measure perhaps as necessary as the vitamin D prophylaxis now being generally adopted.

SUMMARY

1. Both diluted evaporated milk and sterilized whole milk have the same vitamin C content as fresh cows' milk, or about one third of the vitamin C content of mothers' milk.

2. Milk powder, sweetened canned milk, sweetened skimmed milk, buttermilk (either powdered or evaporated) and lactic acid milk powder after dilution contain on an average one-half the vitamin C content of fresh cows' milk, or one-fourth that of mothers' milk.

3. Vitamin C prophylaxis with fruit juice or with (synthetic) ascorbic acid is essential, both with condensed milk products and with foods prepared from fresh milk.

4. Milk powder, sweetened condensed milk, evaporated milk and sterilized milk have a carotene and a vitamin A content which quantitatively lies between that of stall milk and that of pasture milk in Europe (i. e., from 10 to 25 micrograms and from 20 to 55 international units per hundred cubic centimeters of diluted milk).

8. de Haas and Meulemans.[1c,d]

5. Sweetened skimmed milk contains practically no vitamin A substances, which corresponds to the fact that this milk is fatless. The sale of this product for infant feeding should not be permitted.

6. Evaporated buttermilk and buttermilk powder after dilution contain as few A substances as fresh buttermilk.

7. The powder of lactic acid milk contains the amount of carotene and of vitamin A to be found in fresh stall or pasture milk.

8. Vitamin A (carotene) prophylaxis with cod liver oil or with carotene preparations is essential both with condensed milk products and with foods prepared from fresh milk.

HEPATOMEGALY IN JUVENILE DIABETES MELLITUS TREATED WITH PANCREATIC EXTRACT

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Hepatic enlargement is not a common complication of diabetes mellitus. Its incidence is much higher during the first two decades of life than later.[1] Excluding cirrhosis of the liver, the most frequent pathologic change in cases of this type consists of fatty infiltration and degeneration of the liver. The literature on the subject has been meager. White [2] reported on 7 young diabetic patients in whom extensive fatty infiltration was demonstrated at autopsy. In a two and one-half year period Hanssen [1] found that 12 of 44 diabetic patients under 20 years of age had enlargement of the liver.

As a rule, the condition is associated with severe and uncontrolled diabetic involvement.[3] In most cases, adequate management of the diabetes with diet and control and administration of insulin and, more recently, of protamine zinc insulin [3] results in hepatic recession. However, there are instances in which careful dietary management coupled with adequate insulin therapy fails to accomplish a return of the liver to its normal size. We have in our own clinic 4 patients in whom the liver has enlarged progressively in spite of such treatment.

In animal experimentation, similar experiences have been noted. Fisher,[4] Allan and others,[5] Dragstedt and his co-workers [6] and others

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From the Department of Pediatrics and the Pediatric Research Laboratories of the Jewish Hospital.

1. Hanssen, P.: Enlargement of the Liver in Diabetes Mellitus, J. A. M. A. **106**:914 (March 14) 1936.

2. White, P.: Diabetes in Childhood and Adolescence, Philadelphia, Lea & Febiger, 1932, p. 169.

3. Hanssen.[1] White.[2]

4. Fisher, N. F.: Attempts to Maintain Life of Totally Pancreatectomized Dogs Indefinitely by Insulin, Am. J. Physiol. **67**:634 (Feb.) 1924.

5. Allan, F. N.; Bowie, J. J.; Macleod, J. J. R., and Robinson, W. L.: Behavior of Depancreatized Dog Kept Alive with Insulin, Brit. J. Exper. Path. **5**:75 (April) 1924.

(Footnotes continued on next page)

have observed that completely depancreatized dogs,[6] even though they were treated with insulin, showed extensive fatty infiltration and degeneration of the liver. The changes did not occur, however, if the dietetic and insulin therapy was supplemented by the feeding of raw whole pancreas.[7]

Administration of adequate amounts of lecithin or choline to the diet also succeeded in preventing the development of these pathologic changes.[8] However, Ralli and others[9] demonstrated that the feeding of raw pancreas is more effective in accomplishing this end than is the addition of lecithin or choline. Van Prohaska and others[6a] showed that fatty infiltration and degeneration of the liver are not due to the absence of pancreatic juice from the alimentary tract and that administration of this external secretion has no beneficial effect on the hepatic condition. They further indicated that lecithin and choline are probably not the active principles in raw pancreas which are concerned in preventing these changes. The same workers[6b] produced an alcoholic extract of beef pancreas which when administered to depancreatized dogs prevented the appearance of fatty changes of the liver or caused their disappearance if they were already present. On the basis of their results in animals, we undertook a determination of the efficacy of such an extract in 3 of our diabetic patients with hepatomegaly.[10]

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6. (*a*) Van Prohaska, J.; Dragstedt, L. R., and Harms, H. P.: The Relation of Pancreatic Juice to the Fatty Infiltration and Degeneration of the Liver in Depancreatized Dogs, Am. J. Physiol. **117**:166 (Sept.) 1936. (*b*) Dragstedt, L. R.; Van Prohaska, J., and Harms, H. P.: Observations on a Substance in Pancreas (a Fat Metabolizing Hormone) Which Permits Survival and Prevents Liver Changes in Depancreatized Dogs, ibid. **117**:175 (Sept.) 1936.

7. Allen and others.[5] Dragstedt and others.[6b]

8. Hershey, J. M., and Soskin, S.: Substitution of "Lecithin" for Raw Pancreas in Diet of Depancreatized Dogs, Am. J. Physiol. **98**:74 (Aug.) 1931. Best, C. H., and Hershey, J. M.: Further Observations on Effects of Some Component of Crude Lecithin on Depancreatized Animals, J. Physiol. **75**:49 (May) 1932. Best, C. H., and Huntsman, M. E.: Effects of Components of Lecithin upon Deposition of Fat in Liver, ibid. **75**:405 (Aug.) 1932. Best, C. H.; Ferguson, G. C., and Hershey, J. M.: Choline and Liver Fat in Diabetic Dogs, ibid. **79**:94 (July) 1933. Best, C. H., and Channon, H. J.: The Action of Choline and Other Substances in the Prevention and Cure of Fatty Livers, Biochem. J. **29**:2651 (Dec.) 1935.

9. Ralli, E. P.; Flaum, G., and Banta, R.: Results of Feeding Lecithin and Pancreas in Depancreatized Dogs on Liver Fat and Its Saponifiable and Unsaponifiable Fractions, Am. J. Physiol. **110**:545 (Jan.) 1935.

10. Of a group of about forty juvenile patients with diabetes, only four have had enlargement of the liver that persisted for a significant period.

METHOD [11]

The 3 children selected had suffered for a number of years from extensive enlargement of the liver. Previous efforts to cause a reduction in the size of the liver had been unsuccessful. All 3 patients had been under fairly good control and under close supervision.

The pancreatic extract was prepared according to the method of Dragstedt and others.[6b] An extract was obtained from about 5 pounds (2.3 Kg.) of fresh beef pancreas with 5 liters of 95 per cent alcohol by shaking the material vigorously and letting it stand overnight. The alcohol solution was filtered off and was evaporated practically to dryness by vacuum distillation, the temperature of the distilling mixture being kept below 35 C. The residue was then washed three times with ether in a separatory funnel, and the ether layers were discarded. About 1 liter of ether was used in washing. In order to preserve the remaining 100 cc. of solution, sodium chloride was added to make a 3 per cent solution. This solution was then divided into twenty-one equal portions, each constituting the equivalent of approximately 100 Gm. of raw beef pancreas. One portion was given daily in two equal doses.

This type of preparation proved highly unpalatable, however, and in addition it frequently caused gastrointestinal disturbances, so that after several months of treatment the patients rebelled at further therapy. As a result, no extract was administered for varying periods, during which retrogressive changes in the liver were carefully watched for. Eventually the extract, prepared as before, was evaporated in a large flat dish to a dry brown paste by means of a fan and was put up in gelatin capsules coated with phenyl salicylate. Each capsule contained the equivalent of 50 Gm. of the raw beef pancreas. Two capsules were given daily. This medicament was well tolerated. In this manner were provided two separate periods of treatment, with an effective control period whereby the efficacy of the tested material could be better studied.

The management of each patient's diabetic condition was not changed as regards insulin dosage or diet during the treatment with pancreatic extract. In one case (case 2) protamine zinc insulin was given; during this therapy no pancreatic extract was administered. No apparent effect on the hepatomegaly was noted.

During the course of the investigation blood lipid studies were performed at intervals, as indicated in tables 1 to 3, in order that we might note any changes in the blood occasioned by administration of the extract. The methods used in these determinations were as follows:

The lactic acid content was determined by a modification of the method of Mendel and Goldscheider.[12] In developing the color with veratrol solution, the sulfuric acid solution was kept at 0 C. for one hour in order to obtain maximum color.

In preparation of the lipid extracts, the methods of Kirk, Page and Van Slyke [13] were used.

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11. Laboratory procedures were performed by Mr. Sidney Gottfried, of the Pediatric Research Laboratories.

12. Mendel, B., and Goldscheider, I.: A Colorimetric Micro-Method for Quantitative Estimation of Lactic Acid in the Blood, Biochem. Ztschr. **164**: 163, 1925.

13. Kirk, E.; Page, I. H., and Van Slyke, D. D.: Gasometric Microdetermination of Lipids in Plasma, Blood Cells and Tissues, J. Biol. Chem. **106**:203 (Aug.) 1934.

The total cholesterol content was determined on an aliquot of the lipid extract by means of the Liebermann-Burchard reaction.

The free cholesterol content and the unbound cholesterol content were determined according to the procedures of Drekter, Sobel and Natelson.[14]

The lipid phosphorus content was determined by a modification of the method of Fiske and Subbarow[15] as follows: Fifteen cubic centimeters of the petroleum ether extract, equivalent to 0.338 cc. of serum, was evaporated to dryness in a combustion tube; 1.2 cc. of five times normal sulfuric acid, 0.3 cc. of concentrated nitric acid and two glass beads were added. The tube was gently heated with a microburner, which was kept at least 2 cm. away from the bottom of the tube, until the solution was perfectly clear, more nitric acid being added, a drop at a time, if necessary. The flame was then lowered, and the tube was heated until white fumes appeared and then heated for ten minutes longer. The tube was cooled for five minutes, and 1 cc. of a 15 per cent solution of sodium sulfate was added to remove the excess nitric acid. The tube was then gently heated two minutes longer to remove any sulfur dioxide present. The contents were cooled and diluted to 6 cc., and an aliquot of 5 cc. was removed into a 10 cc. volumetric flask. From this point the colorimetric procedure of Fiske and Subbarow was followed.

The total serum lipid content was determined by the manometric method of Van Slyke, Page and Kirk.[16]

REPORT OF CASES

Case 1.—S. C. first came to the outpatient department of the Jewish Hospital on June 19, 1926, at the age of 6 years. Diabetes mellitus had developed when he was 4 years of age, and he had been treated elsewhere for two years with strict dietary regulation and insulin. His diabetic condition was kept well under control during the eleven years that he was under our care in the pediatric diabetic clinic. His urinary excretion of dextrose, although occasionally excessive when he exceeded his diet, usually averaged approximately 13 Gm. in twenty-four hours. His average insulin requirement during the past four years had been 20 units twice a day.

From the onset of diabetes, there was noted a significant retardation in growth. The average annual increment in height had been 1 9/16 inches (4 cm.). Although he had recently made a greater gain in height than at any previous time, he was only 61½ inches (156.2 cm.) tall on entry. He weighed 105 pounds (47.6 Kg.).

In January 1933 the patient was admitted to the hospital because of intermittent abdominal pain localized about the umbilicus. A thorough investigation failed to disclose a satisfactory cause for the pain. About one year later acute, low

14. Drekter, I. J.; Sobel, A. E., and Natelson, S.: Fractionation of Cholesterol in Blood by Precipitation as Pyridine Cholesteryl Sulphate and Cholesterol Digitonide, J. Biol. Chem. **115**:391 (Sept.) 1936. Sobel, A. E.; Drekter, I. J., and Natelson, S.: Estimation of Small Amounts of Cholesterol as Pyridine Cholesterol Sulfate, ibid. **115**:381 (Sept.) 1936.

15. Fiske, C. H., and Subbarow, Y.: Colorimetric Determination of Phosphorus, J. Biol. Chem. **66**:375 (Dec.) 1925.

16. Van Slyke, D. D.; Page, I. H., and Kirk, E.: A Manometric Micromethod for Determination of Carbon in Organic Compounds, J. Biol. Chem. **102**:635 (Oct.) 1933.

grade catarrhal jaundice set in, but it cleared within two or three weeks. On Dec. 9, 1935, after a period of three weeks during which there had been an infection of the upper respiratory tract, with chills and fever, the patient complained of similar abdominal pain accompanied by nausea but no vomiting. Jaundice appeared the next day, with tenderness and enlargement of the liver, the edge extending 3 inches (7.6 cm.) below the right costal margin in the midclavicular line. All the symptoms except hepatomegaly disappeared within two or three weeks. The liver receded to a level 1 inch (2.5 cm.) below the right costal border. However, shortly thereafter a slow but progressive enlargement of the liver recurred in spite of the fact that the patient's urinary excretion of dextrose was only 3 to 10 Gm. He was given a diet which was rich in lecithin and choline as

TABLE 1.—*Effect of Pancreatic Extract on Hepatomegaly and Blood Lipid Content in Case 1*

			Serum Lipid†					
Therapy	Date	Size of Liver*	Total Lipids	Total Cholesterol	Free Cholesterol	Unbound Cholesterol	Total Lipid Phosphorus	Lactic Acid
First period: patient treated with saline solution of pancreatic extract for approximately 5 mo.	5/16/36	3¾	1,044	215.4	41.6	27.8	10.1	....
	6/15/36	1½	776	202.7	59.0	24.1	8.8	20.3
	7/20/26	1	706	198.0	53.2	20.0	8.6	16.0
	9/ 9/36	At costal margin	908	200.7	48.3	18.6	9.4	18.9
	10/26/36	Not palpable	965	241.1	64.7	25.5	9.5	21.6
Second period: no pancreatic extract given for approximately 2 mo.	10/26/36	Not palpable	965	241.1	64.7	25.5	9.5	21.6
	12/ 5/36	¾	717	220.1	58.9	21.7	8.3	16.7
	12/26/36	2¼	...	.....	....	....	....	....
Third period: treatment with a desiccated pancreatic extract in capsules coated with phenyl salicylate for approximately 4 mo.	12/26/36	2¼	...	.....	....	....	....	....
	2/20/37	2	675	235.0	57.1	29.0	8.6	16.3
	3/ 6/37	¾	...	.....	....	....	....	....
	4/17/37	Not palpable	...	.....	....	....	....	....
	5/22/37	Not palpable	737	.....	....	....	5.8	18.8

* In tables 1 to 3 the figures represent the distance in inches between the lower margin of the costal border and the lower edge of the liver in the midclavicular line.

† In tables 1 to 3 the values are given in milligrams per hundred cubic centimeters.

well as a commercial pancreatic extract daily. The liver remained large in spite of treatment. On May 16, 1936, the lower margin of the liver was 3¾ inches (9.5 cm.) below the right costal margin in the midclavicular line. Liver function tests all gave normal results.

At this time the saline solution of the pancreatic extract was administered. This was continued until October 28, when the patient protested against taking the medicament. Since the liver had receded so that it was just palpable while the patient was under this medication, the extract was discontinued in order that we might determine the effect of cessation of treatment. By December 26, after two months without therapy, the liver was again enlarged, the border being 2¼ inches (5.7 cm.) below the costal margin. On that date, pancreatic extract was again given in capsules coated with phenyl salicylate, which were well tolerated. By April 17, 1937, about four months later, the liver was no longer palpable (table 1).

CASE 2.—A. E. was first admitted to the Jewish Hospital on Sept. 23, 1925, in diabetic coma. He was then 8 years old. Diabetes had developed at the age of 3½ years. During the first year of his illness the child had not received insulin. He was subsequently given dietary and insulin therapy. On fifteen different occasions he was admitted to the hospital because of acidosis or for regulation of his diabetic condition. His diabetes had always been severe, and he required as much as 100 units of insulin daily. His average urinary excretion of sugar, aside from occasions of dietary indiscretion, had been 18 Gm. in twenty-four hours, while his average insulin requirement had been 42 units twice a day.

He had always been short, his average yearly growth being only 1 5/16 inches (3.4 cm.). He was 61¼ inches (155.6 cm.) in height at the beginning of the present study.

TABLE 2.—*Effect of Pancreatic Extract on Hepatomegaly and Blood Lipid Content in Case 2*

			Serum Lipid						
Therapy	Date	Size of Liver	Total Lipids	Total Cholesterol	Free Cholesterol	Unbound Cholesterol	Total Lipid Phosphorus	Lactic Acid	Comment
First period: administration of saline solution of pancreatic extract for approximately 5 mo.	7/11/36	3½	1,236	247.6	62.5	25.2	10.5	19.5	Patient took the extract irregularly and probably infrequently
	7/27/36	3½	1,021	205.1	56.4	24.3	11.8	22.8	
	9/19/36	3¼	.....	.....	....	....	....	....	
	10/18/36	3½	606	206.6	48.3	17.4	8.8	16.2	
	12/19/36	3	...	.....	....	....	....	....	
Second period: approximately 6 wk., no pancreatic extract therapy; protamine zinc insulin was administered	12/19/36	3	...	.....	....	....	....	....	Diabetic condition well controlled with protamine zinc insulin
	1/ 9/37	3	...	.....	....	....	....	....	
	2/ 1/37	3⅝	631	195.3	55.5	18.4	7.8	29.2	
Third period: approximately 3 mo., treatment with desiccated pancreatic extract in capsules coated with phenyl salicylate	2/ 1/37	3⅝	631	195.3	55.5	18.4	7.8	29.2	Patient took capsules regularly
	2/13/37	1	...	.....	....	....	....	....	
	3/ 3/37	½	...	.....	....	....	....	....	
	3/14/37	½	560	190.0	54.0	23.5	8.0	20.9	
	3/24/37	Just palpable	...	.....	....	....	....	....	
	5/27/37	Not palpable	530	.....	....	....	5.7	22.2	

Aside from occasional episodes of acidosis, his progress was uneventful until Feb. 16, 1935, when there were noted progressive enlargement of the abdomen and enlargement of the liver, which soon reached the level of the umbilicus. There was tenderness in the right upper quadrant, and scleral evidence of jaundice was observed. On February 19 the boy was admitted to the hospital, where he stayed until March 8. The diagnosis was hepatomegaly resulting from fatty infiltration secondary to diabetes mellitus. The jaundice cleared spontaneously, but the liver remained enlarged. All tests for liver function gave normal results during the patient's stay in the hospital.

In spite of adequate control of the diabetes and administration of a diet rich in lecithin and choline together with a commercial pancreatic extract, the hepatic enlargement continued. On July 11, 1936, the pancreatic extract prepared by us was given in saline solution. The liver at the time was 3½ inches (8.9 cm.) below the right costal margin in the midclavicular line. Because of the unpleasant

taste and other unfavorable effects of the preparation, the patient did not take it regularly, and the liver failed to decrease in size. On December 19 the therapy was discontinued. The boy was then given protamine zinc insulin (100 units daily), that we might determine whether a reduction in the size of the liver could be effected with this substance alone. However, by Jan. 30, 1937, his liver was 3 9/16 inches (9.1 cm.) below the costal margin, in spite of the favorable effect of this new insulin preparation on his diabetic status.

On this date the patient was given the pancreatic extract in capsules coated with phenyl salicylate. He took these regularly, with the result that in two weeks the edge of the liver was only from ¾ to 1 inch (1.9 to 2.5 cm.) below the costal margin and by April 24 was barely palpable. It could not be felt on June 1 (table 2).

TABLE 3.—*Effect of Pancreatic Extract on Hepatomegaly and Blood Lipid Content in Case 3*

			Serum Lipid						
Therapy	Date	Size of Liver	Total Lipids	Total Cholesterol	Free Cholesterol	Unbound Cholesterol	Total Lipid Phosphorus	Lactic Acid	Comment
First period: approximately 3 mo., treatment with saline solution of pancreatic extract	8/20/36	5	1,058	182.0	49.2	26.4	8.6	34.1	Patient occasionally omitted taking preparation especially toward end of first period
	9/ 5/36	3	.....	.....	....	....	....	....	
	10/ 7/36	2	961	222.0	61.6	22.2	7.8	17.2	
	12/ 2/36	1½	843	227.4	67.1	21.6	7.8	21.0	
Second period: approximately 1 mo., no pancreatic extract therapy	12/ 2/36	1½	843	227.4	67.1	21.6	7.8	21.0	
	1/ 2/37	2½	...	.....	....	....	....	....	
Third period: approximately 3 mo., treatment with desiccated pancreatic extract in capsules coated with phenyl salicylate	1/ 2/37	2½	...	.....	....	....	....	....	Patient took pancreatic extract regularly
	2/13/37	1¾	709	222.0	67.0	20.2	7.4	21.7	
	3/17/37	1	...	.....	....	....	....	....	
	4/ 1/37	Not palpable	...	.....	....	....	....	....	
	5/17/37	Not palpable	665	.....	....	....	6.7	20.7	

CASE 3.—W. S. was admitted to the Jewish Hospital for the first time on Dec. 8, 1926, at the age of 3 years, several days after the discovery of sugar in his urine. At the age of 8 years a benign type of pulmonary tuberculosis developed. There was a history of exposure to tuberculosis at home. The pulmonary condition cleared spontaneously and never recurred. The diabetes was of moderate severity and was controlled fairly easily, except occasionally when he exceeded his diet. He required an average of 18 units of insulin twice a day. Because he never rigidly adhered to his diet, there had been glycosuria, an average of 25 Gm. of sugar being excreted in twenty-four hours. He was readmitted to the hospital three times for acidosis, which was usually secondary to an infection or a disease of childhood. He had had no attacks since 1928. He was short, measuring only 55¾ inches (141.6 cm.). For the past ten years his average annual increase in height had been 1 9/16 inches (4.2 cm.).

On April 2, 1932, it was noted that his liver was 2 inches (5.1 cm.) below the right costal margin in the midclavicular line, but no symptoms were observed.

On Sept. 6, 1935, jaundice developed and the liver was found to extend 2½ inches (6.3 cm.) below the costal margin. Two weeks later the liver had receded spontaneously to a level 1½ inches (3.8 cm.) below the costal margin, and the jaundice had cleared. However, shortly thereafter the liver again increased in size; by July 25, 1936, it extended 5 inches (12.7 cm.) below the costal margin.

On August 19 the saline solution of the pancreatic extract was given for the first time. The liver slowly receded; by November 28 it was only 1½ inches below the costal margin. As disagreeable gastric symptoms had again been caused by the medication, on this date the use of the pancreatic extract was discontinued. On Jan. 2, 1937, the liver had enlarged again to a level 2½ inches below the costal margin. At this time, administration of the partially desiccated extract in capsules coated with phenyl salicylate was started. Under this therapy the liver decreased in size; by May 1 it was no longer palpable (table 3).

COMMENT

The 3 cases represent hepatomegaly of several years' duration which occurred during the course of diabetes mellitus. Certain clinical features which they possess in common should be emphasized. The onset of the diabetes came early in life, at an age of 3 to 4 years. The patients' statures were always short as compared with the averages for their ages. In each case there occurred one or more attacks of acute hepatitis with jaundice, which subsided after a time, although hepatomegaly persisted. The attacks of acute hepatitis were not the cause of the hepatic enlargement but were probably precipitated by the underlying primary condition in the liver.

Careful control of the diet and adequate insulin therapy were unsuccessful in reducing the size of the liver. The diabetic condition was maintained in what is ordinarily regarded as a satisfactory state of control. The patients were in a good state of health and nutrition. Their dosages of insulin were kept fairly constant. Determination of blood sugar at frequent intervals did not reveal unusual hyperglycemia, and as a rule there had been no excessive glycosuria. Blood cholesterol findings were always within normal limits. Aside from hepatomegaly, there was absence of all other complications or undesirable sequelae of diabetes mellitus. There were consequently no signs of unfavorable progression of the disease over periods of nine to eleven years. Yet, in spite of the apparently satisfactory regulation of the diabetic state, progressive hepatomegaly had developed.

The studies of the blood lipid (tables 1 to 3) revealed certain findings common to all 3 cases. The initially high level of total lipids tended to become much lower with administration of the extract. A similar tendency was observed in the concentrations of the lactic acid and lipid phosphorus of the blood. These low values were noted even during the second period (the period of no medication), although the liver

in each instance again became enlarged. The values of total free and unbound cholesterol, which throughout our studies were within normal range, remained materially unchanged with or without pancreatic therapy.

Several discrepancies should be described. Table 1 reveals recession in the size of the liver in the first period, with a striking decline of the blood lipid content. Yet in spite of the continued recession of the liver to normal size, the level of the total lipids again became elevated toward the end of that period. Similar findings may be noted in the case of lipid phosphorus and lactic acid. We are at a loss to account for these findings.

In table 2 is seen a significant depression of the total blood lipid content and the lipid phosphorus content in the first and second periods, although there was no change in the size of the liver. A possible explanation is that because of the intermittent manner in which the medicament was taken, the liver did not consistently recede, although sufficient extract was ingested to exert an effect on the blood lipids.

The absence of an elevation in the level of the blood lipids during the second period, when the liver became enlarged while pancreatic therapy was withheld, involves the following considerations: It is possible that the effect of the pancreatic extract is reflected in lowering of the level of the blood lipids earlier than in reduction in the size of the liver. On the other hand, there may be a quantitative relation, a smaller amount of the extract being sufficient to cause lowering of the blood lipid level than is necessary to cause reduction in the size of the liver. Another explanation is that there occurs a considerable degree of fatty infiltration of the liver with secondary enlargement before the level of the total lipids becomes significantly elevated.

The saline solution of the pancreatic extract was effective in bringing about a marked reduction in the size of the liver in cases 1 and 3. The failure of the saline preparation in case 2 was evidently due to the fact that its use was discontinued because of the patient's lack of cooperation. The partially desiccated extract given in capsules was completely effective in all 3 cases because this mode of administration made cooperation easier (tables 1 to 3).

One can reasonably assume that it was introduction of the specially prepared pancreatic extract in addition to dietary and insulin therapy that was responsible for recession of the liver in these 3 juvenile diabetic patients. Previous attempts to reduce the size of the liver by careful control of diet and adequate insulin treatment had been unsuccessful. Furthermore, the addition of food rich in lecithin and choline had failed to produce any appreciable effect on the enlargement of the liver. Admin-

istration of the alcoholic extract of the pancreas caused a reduction in the size of the liver within from three to five months. When use of the extract was discontinued, hepatomegaly recurred. Further administration of the extract brought about a recession in the size of the liver to normal, the success of the therapy being demonstrated beyond a reasonable doubt. To prevent the development of hepatomegaly in these cases, therefore, it appears that one must administer this preparation continuously.

It is felt that we have been dealing with a fatty infiltration of the liver due to an impairment of fat metabolism which is not satisfactorily relieved by dietary and insulin treatment but which is corrected by administration of an alcoholic pancreatic extract. This view is supported by animal experiments and by the few clinical studies of this condition in human beings.[17] The striking effects of this preparation in our young diabetic patients with hepatomegaly indicate strongly that we have been dealing with a condition similar to that found in depancreatized animals.

Although Hanssen,[1] White [2] and others have expressed the opinion that fatty infiltration in the liver is the pathologic lesion in such cases, they have maintained that it is always due to inadequate control of the diabetic state and that hepatomegaly recedes with satisfactory management of the diabetic condition, particularly with the use of protamine zinc insulin. While we agree essentially with this view, we feel that there are exceptions. There are a significant number of patients whose response to dietary regulation and to insulin or protamine zinc insulin therapy is far from satisfactory. In these instances, failure to control completely the carbohydrate metabolic processes leads to disturbances in hepatic regulation of carbohydrate and fat metabolism and eventually produces deposition of fat in the liver. In such cases pancreatic extract may be of decided value. It is possible that in spite of adequate regulation of the diabetes with dietary and insulin therapy there is in some cases absence or only inadequate amounts of some factor essential to regulation of the utilization and deposition of the fat by the liver. Dragstedt and others [6b] in their report on depancreatized dogs stated the belief that this lipotropic substance is present in the alcoholic pancreatic extract. Whether this view is correct or not, the fact remains that the addition of an alcoholic pancreatic extract is of decided benefit in accomplishing the resorption of the fatty deposit in the liver of human beings with diabetes. If this therapy is not specific, it is at least a valuable adjuvant in the treatment of the fatty infiltration of the liver which occurs in patients with diabetes mellitus.

17. Hanssen.[1] White.[2] Fisher.[4] Allan and others.[5] Dragstedt and others.[6b]

SUMMARY AND CONCLUSIONS

In 3 young diabetic patients with persistent hepatomegaly, striking recession of the liver to its normal size was demonstrated only after the addition of a specially prepared pancreatic extract. Adequate management of the diabetic condition with dietary control and insulin therapy alone had failed to accomplish this result.

The pancreatic preparation must be continuously administered to prevent recurrence of hepatomegaly.

The dramatic recession of hepatomegaly and the marked lowering of the level of the blood lipids following administration of the extract justify the tentative assumption that the enlargement of the liver in our cases was due to fatty infiltration and that the therapeutic agent is a lipotropic substance. Animal experimental data and postmortem observations on human beings by other investigators tend to corroborate this view.

SIZE OF THE HEART IN HEALTHY CHILDREN

ROENTGEN MEASUREMENTS OF THE CARDIAC AREA AND TRANSVERSE DIAMETER FOR SIXTY-SEVEN CHILDREN BETWEEN BIRTH AND THE AGE OF SIX YEARS

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Many excellent articles have appeared in recent years on the size of the heart in normal children. Those by Bardeen,[1] von Bernuth,[2] Hodges, Adams and Gordon,[3] Bakwin and Bakwin[4] and Josephi[5] dealt with teleroentgenograms of normal children and with determinations of cardiac surface area and diameter as compared with body surface area, height, weight and age. Veith[6] did the same type of work with orthodiagrammatic observations. All the results were determined by the cross-sectional type of study, although in some instances repeated observations were made on the same subjects. Hodges, Adams and Gordon presented a prediction formula for cardiac surface area in September 1933. The formula, cardiac area $= 0.180\ H + 1.045\ W + 13.7$, was based on the study of 169 normal children between the ages of 3 and 19 years. Von Bernuth's study led him to predict that the relation $\frac{\text{height (in centimeters)} \times \text{internal diameter of chest}}{\text{cardiac area}}$ would normally give a quotient of 31 to 47 for older children and of 29 to 44 for infants. Josephi checked his measurements against both these formulas. For only 53 per cent of 100 children in his study was the observed cardiac area within $\pm$ 10 per cent of the predicted area according to the formula of Hodges, Adams and Gordon, and for 47 per cent the observed cardiac area was

From the Child Research Council and the School of Medicine of the University of Colorado.

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from 11 to 30 per cent greater than the predicted value. The quotient $\frac{\text{height} \times \text{internal diameter of chest}}{\text{cardiac area}}$ showed for von Bernuth's data a larger range than in Josephi's series. However, when the range was set at the mean plus and minus two standard deviations, 96 per cent of the values for both boys and girls in von Bernuth's series and 98 per cent of the values for boys and 100 per cent of those for girls in Josephi's series fell within this range. Josephi then derived the quotient $\frac{\text{body surface area}}{\text{cardiac area}}$ and found that with the range including the mean plus and minus two standard deviations, the values were between 11.5 and 15.5 for 77 per cent of the boys and 79 per cent of the girls in von Bernuth's series and for 91 per cent of the boys and 89 per cent of the girls in his series. For the smaller children the number of subjects was limited, but the quotients seemed to be somewhat lower.

The present study was undertaken to obtain, if possible, information regarding the growth of the heart as evidenced by the measurements of the frontal plane silhouette of the heart in roentgenograms taken for the same children at three month intervals since birth. The values obtained were checked against the quotients proposed by von Bernuth and by Josephi. Correlation coefficients were calculated between the measured cardiac surface area and the total transverse diameter of the heart against height, weight, age, body surface area, the internal diameter of the chest and the value suggested by von Bernuth: height $\times$ internal diameter of the chest.

MATERIAL AND METHOD

The subjects used for this study were taken from the group of children who are being examined by the Child Research Council from birth to maturity. The children, 38 boys and 29 girls, were all between 6 months and 6 years 4 months of age at the time this survey was begun, and roentgenograms have been made for them at periodic intervals since birth. A total of 1,026 roentgenograms have been measured. The children have had routine physical examinations at each roentgen examination, and electrocardiograms have been made twice a year. No evidence of cardiac disease has been found in any subject. For only 2 of these children were examinations begun later than during the second month of life. These 2 later joined the group which had been studied from birth, 1 of them at 3 months and 1 at 1 year of age. The number of roentgenograms made for each child varied from 3 to 25. For each of 5 children there were from 3 to 5 roentgenograms; for 22 children, from 6 to 15, and for 40 children, from 16 to 25. At the time of the last examination, 4 children were less than 1 year old, 8 between 1 and 2 years, 7 between 2 and 3 years, 13 between 3 and 4 years, 19 between 4 and 5 years, 14 between 5 and 6 years and 2 between 6 years and 6 years 4 months.

Roentgenograms for infants and younger children were taken with the subject in the supine position, the casette being placed at the anterior wall of the chest and the roentgen tube 5 feet (1.5 meters) below the table. After the children were 3 or 3½ years old, the examinations were made in the dorsoventral posi-

tion at a distance of approximately 7 feet (2.1 meters). Exposures were from one-tenth to one-twentieth second. Attempts were made to obtain roentgenograms at the height of inspiration with all children, but this was not always possible with the younger subjects. Body weight and height were recorded at each examination. The measurements made from the roentgenogram include the maximum diameters of the right and left sides of the heart, which together give the

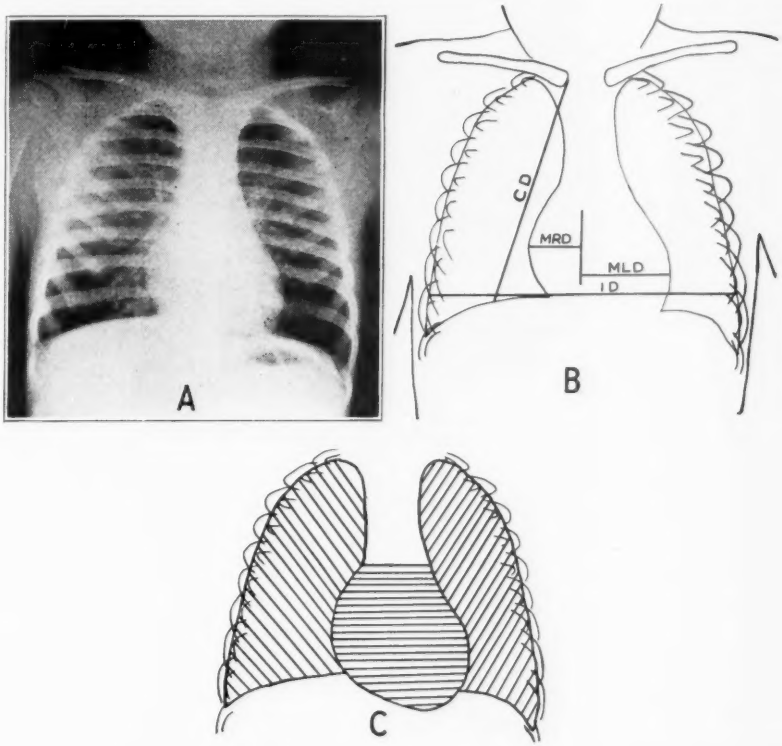

Fig. 1.—*A* is a roentgenogram of the chest. *B* is a schematic representation of the measurements made directly from the roentgenogram shown in *A*. *MRD* refers to the transverse diameter of the right side of the heart, measured from a line drawn through the middle of the spine to the most distant point on the right side of the heart. *MLD* refers to the maximum diameter of the left side of the heart, measured from a line drawn through the middle of the spine to the most distant point on the left side of the heart. *ID* represents the internal diameter of the chest, measured at the level of the dome of the diaphragm on the right, from the pleural surface on the right to that on the left. *CD* refers to the clavicular-diaphragmatic distance as measured from the sternal end of the right clavicle to the midpoint of the right side of the diaphragm. *C* is a reproduction of the tracing made from the roentgenogram for measuring the cardiac area and the area of the pulmonary fields. The lower border of the heart has been completed from a study of the roentgenogram. A horizontal line has been drawn at the base of the heart. The cardiac area is shaded with horizontal lines and the pulmonary area with oblique lines.

total transverse diameter; the internal diameter of the chest measured at the level of the dome of the right side of the diaphragm, and the length of the line from the sternal end of the right clavicle to the midpoint of the right side of the diaphragm (fig. 1 *A* and *B*). From the two measurements last mentioned the degree of inspiration was judged (Allen and Waltz [7]). Complete expiration (O) was said to be present if the quotient $\frac{\text{clavicular-diaphragmatic distance}}{\text{internal diameter of the chest}}$ was 50 per cent or less; complete inspiration (4+) was said to be present if this ratio was 66 per cent or more; 1+ inspiration was arbitrarily set at from 51 to 55 per cent; 2+ inspiration, at from 56 to 60 per cent, and 3+ inspiration, at from 61 to 65 per cent.

Tracings were then made from the roentgenograms on large sheets of paper, the visible heart borders, the diaphragm and the pleural surfaces of the pulmonary fields being outlined as accurately as possible. The lower border of the heart from the left to the right cardiodiaphragmatic angle was reconstructed on each tracing from a careful study of the roentgenograms. At the base of the heart a horizontal line was drawn at the level of the cardiac notch formed by the right auricle and the great vessels. This area (the frontal plane silhouette of the heart) and the area of the pulmonary fields were then determined with a Dietzen planimeter (fig. 1 *C*). All measurements were made by one person (M. M.).

It is realized that there might be objections to measuring the surface area from tracings. We found, however, that the technical difficulties were less and the measurements could be checked more accurately when we used tracings than when we worked directly from the roentgenograms.

Measurements of these tracings were recorded, as well as the height, weight, age and body surface area of each child at the time each roentgenogram was taken. Values for the body surface areas were obtained from the nomograms constructed from the Du Bois and Du Bois [8] height-weight formula by Boothby and Sandiford [9] for older children and by Hannon [10] for infants and younger children.

COMMENT ON RESULTS

Most writers have expressed the opinion that cardiac surface area may serve as a better index of the size of the heart than any of the routine measurements of the roentgenogram. The correlation between cardiac area and body surface area is greater than that between cardiac area and height, weight or age or between other cardiac measurements and body surface area, height, weight or age. However, in any survey a certain number of hearts are either considerably smaller or somewhat larger than the rest, and no good explanation for such marked variations in size has been advanced.

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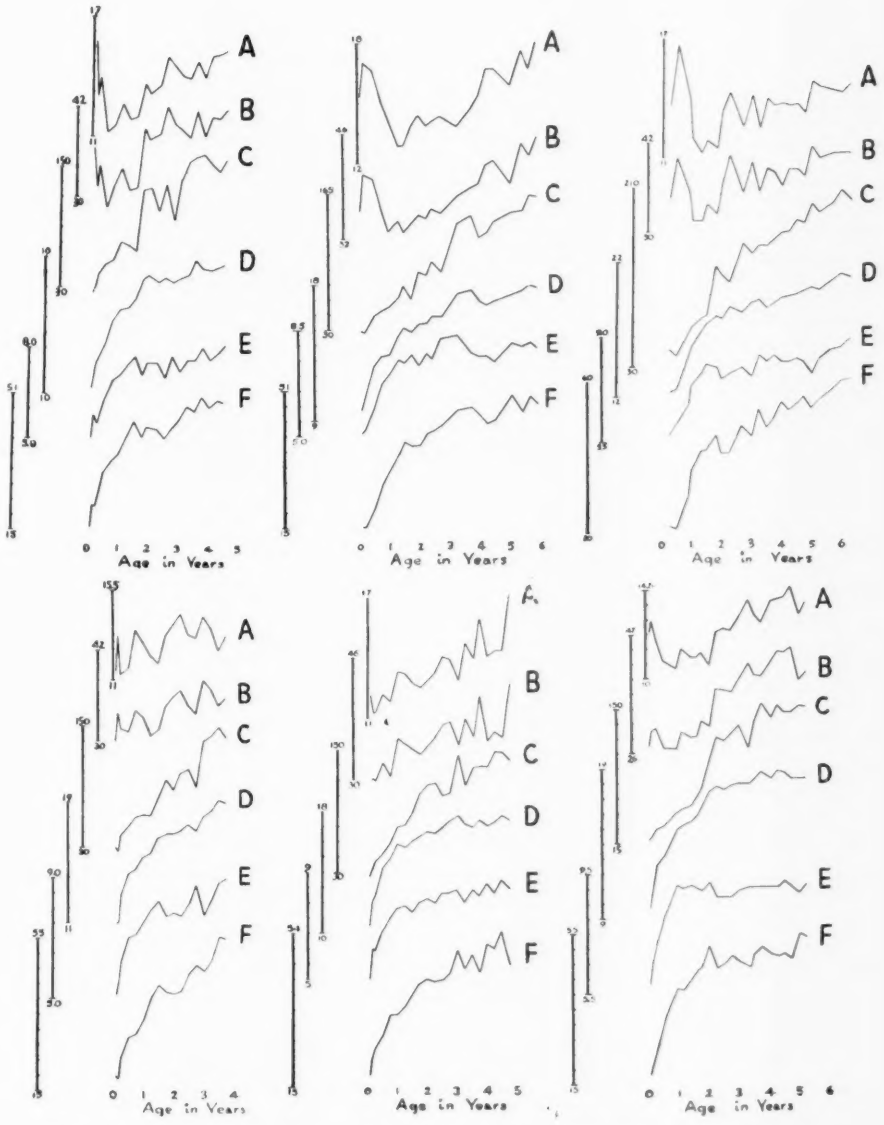

Fig. 2.—Composite charts of 6 girls (taken as fair samples of the group), showing curves for the values of *A*, the quotient proposed by Josephi, $\frac{\text{body surface area}}{\text{cardiac area}}$; *B*, the quotient proposed by von Bernuth, $\frac{\text{height} \times \text{internal diameter of chest}}{\text{cardiac area}}$; *C*, the surface area of the pulmonary fields (in square centimeters); *D*, the internal diameter of the chest (in centimeters); *E*, the total transverse diameter of the heart (in centimeters), and *F*, the cardiac area (in square centimeters). All values are referred to age in years. Each chart includes all measurements made from the roentgenogram and tracings for each child. The same scale is used throughout.

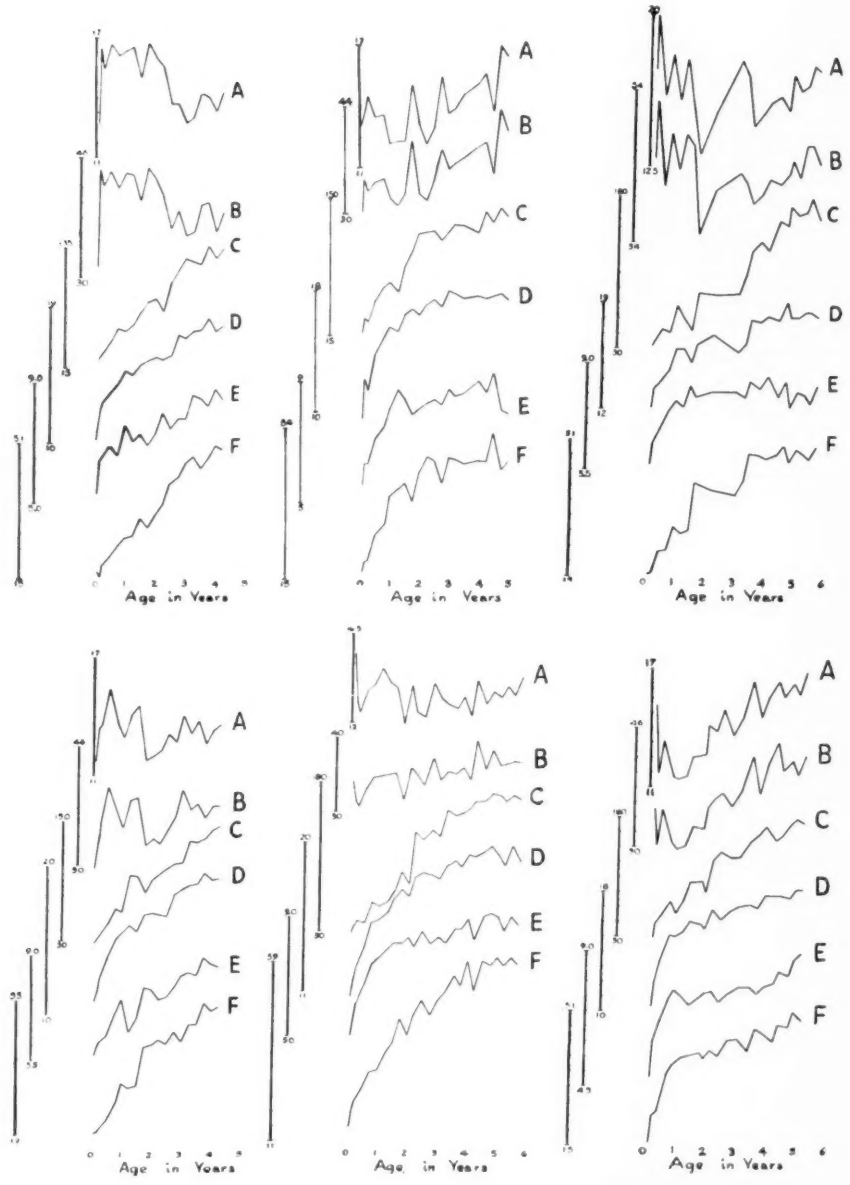

Fig. 3.—Composite charts of 6 boys (taken as fair samples of the group), showing curves for the values of *A*, the quotient proposed by Josephi, $\frac{\text{body surface area}}{\text{cardiac area}}$; *B*, the quotient proposed by von Bernuth, $\frac{\text{height} \times \text{internal diameter of chest}}{\text{cardiac area}}$; *C*, the surface area of the pulmonary fields (in square centimeters); *D*, the internal diameter of the chest (in centimeters); *E*, the total transverse diameter of the heart (in centimeters), and *F*, the cardiac area (in square centimeters). All values are referred to age in years. Each chart includes all measurements made from the roentgenogram and tracings for each child. The same scale is used throughout.

In our work, we discovered considerable variation in the size of the heart on repeated examinations of the same child, in addition to the marked individual differences. For none of the children were growth curves smooth. The differences between individual children at any given height, weight or age, as well as the marked and unpredictable variations in any single child during growth, were demonstrated most strikingly by growth curves for all measurements on each of the children studied. The curves of 6 boys and 6 girls, selected as fair samples for the whole group, are shown in figures 2 and 3. Growth in cardiac area is compared with growth in the diameters of the heart and chest, with increase in the area of the pulmonary fields and with the quotients suggested by Josephi and by von Bernuth. The same scale was used on all charts. The tendency of both quotients to give high values in the early months is of particular interest when one considers that the divisor in each case is the figure for cardiac area. In other words, the cardiac area is small in proportion to either body length or surface area at this age. That the increase in cardiac area with growth does not parallel the increase in body length or in surface area during the first six years is also seen clearly when one studies the curves in figures 2 and 3. The rapid growth of the heart in the first year, with the consequent drop in the two quotients, is constant in most cases. After the first year, however, there is a rather marked degree of individual variation, with a general tendency for other body measurements to increase more rapidly than cardiac area, so that the quotients show an upward trend, approaching their early high figure between the fourth and the sixth year. The irregularities in the other curves apparently bear little relation to each other.

We first considered whether the degree of inspiration, as measured by the surface area of the pulmonary fields or by the method of Waltz and Allen, might not be a factor in the individual fluctuations. However, plotting the surface area of the pulmonary fields on the same chart with the cardiac measurements against age revealed no tendency for the irregularities in the growth curves to occur at the same time (figures 2 and 3). No correlation, either direct or indirect, could be made out from a study of these graphs. A scatter chart was then made for cardiac area against surface area of the pulmonary fields, with various symbols for the different degrees of inspiration (fig. 4). This showed a tendency for the largest hearts and the smallest surface areas of the pulmonary fields to be found in the roentgenograms taken at either 0 or 1 + inspiration. But this was not always true; and the converse (smallest heart and greatest surface area of the pulmonary fields) was seen as frequently in the roentgenograms taken at 0, 1 +, 2 + or 3 + inspiration as in those taken at 4 + inspiration. We were

therefore obliged to discard the idea that the variation in degree of inspiration shown in various roentgenograms made for the same child might be the chief cause for the changes in the size of the heart noted at successive examinations.

It is probable that when a large series of roentgenograms is made for a single child they will be taken during different stages of the

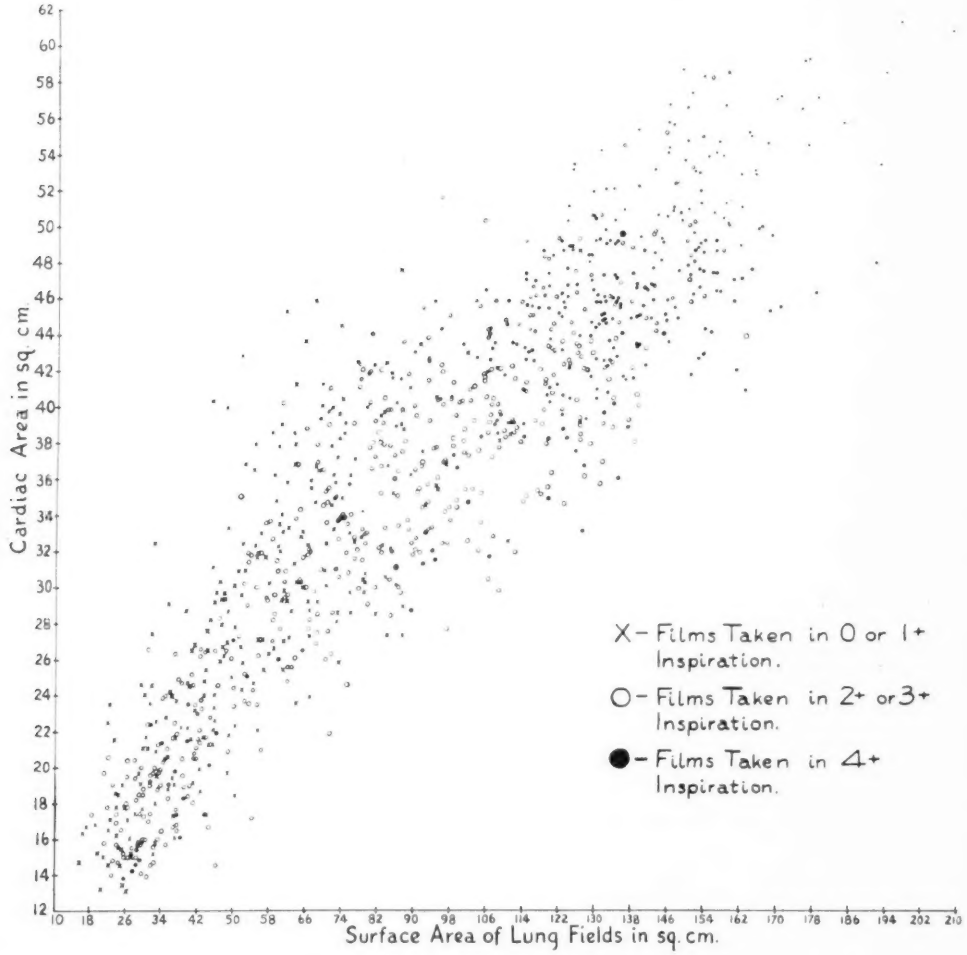

Fig. 4.—Scatter diagram of 1,026 measurements of cardiac area referred to surface area of the pulmonary fields (in square centimeters). The crosses represent the roentgenograms which gave values of 55 per cent or less for the ratio $\frac{\text{clavicular-diaphragmatic distance}}{\text{internal diameter of chest}}$; the hollow circles represent roentgenograms which gave values of from 56 to 65 per cent for this ratio, and the solid circles represent roentgenograms which gave values of 66 per cent or more. This figure, as well as figures 5, 6, 7 and 8, represents measurements made from roentgenograms of 38 boys and 29 girls.

cardiac cycle. However, these variations (the cardiac area decreasing as much as 5 or 6 sq. cm. and the transverse diameter as much as 6 or 7 mm. in three months) seem well outside the expected range between the height of systole and complete diastole.

So far we have no satisfactory explanation for these variations. One may grant the possibility of some actual variation in the size of the cardiac silhouette dependent on such factors as differences in the cardiac cycle, varying degrees of activity of the child and slight changes in position during the taking of the roentgenograms. One must also admit that a certain proportion of the variability may depend on errors in the technic of measuring. The latter factor would more directly concern measurements of the cardiac area than measurements of diameter, in which the error is small. Yet the transverse diameters show the same general type of variation. What seems to us important, regardless of the exact cause of these variations, is recognition of their existence. It would seem to be a matter of some practical importance that even in carefully taken roentgenograms such variation exists in the measurements made on the same child at three month intervals.

Further analysis of these individual graphs (figs. 2 and 3) is of some interest in this connection. In 48 per cent of the graphs, the trends of the curves for cardiac area and transverse diameter were similar but neither curve was smooth. The irregularities in the curves were of approximately the same degree, but these irregularities did not always occur simultaneously. In 26 per cent of the graphs, the curves for cardiac area and transverse diameter were both irregular but the trend was not the same. In 14 per cent, the trend was similar but the curve for cardiac area was smoother than that for transverse diameter. In 9 per cent, the curve for cardiac area was smoother than that for transverse diameter but the trend was different. In the remaining 3 per cent, the curve for the transverse diameter was smoother than that for cardiac area, with similar trends. These percentages were calculated from data for the whole group of children; since 12 of the 67 subjects had less than 10 roentgenograms each, perhaps the percentages do not give a true picture of the relation of the curves. However, the similarities in the graphs of the majority of the older children lead us to believe that for routine estimation of cardiac size perhaps too much emphasis has been placed on the advantages of measuring cardiac area. It is realized that with a cross-sectional type of statistical study determinations of cardiac area show definite advantages over measurements of total transverse diameter. But with study of the individual child over a number of years, the growth curves of cardiac area and of cardiac transverse diameter plotted against age are similar in about half our cases.

When scatter charts were made of cardiac measurements plotted against height, weight, age, internal diameter of the chest, body surface area and the values for height × internal diameter of chest, the means gave similar curves. The two comparisons shown in figures 5 and 6 illustrate this whole group of scatter charts. The scatter is greater with measurements of transverse diameter than with those of cardiac area, and the standard deviation is larger. Correlation coefficients are given, although they cover a period of growth (from birth to the age of 6 years) and a strictly linear relation may not exist. Since no essential difference was found between boys and girls in their means or correlation coefficients, values are given as one set of figures in table 1.

TABLE 1.—*Correlation Coefficients Obtained in the Present Study* Compared With Those of Josephi*[5]

		Present Study	Josephi
Height × internal diameter of chest....	Cardiac area.....	0.939	....
Body surface area.....	Cardiac area.....	0.932	0.90
Internal diameter of chest.....	Cardiac area.....	0.926	....
Height.....	Cardiac area.....	0.922	0.87
Weight.....	Cardiac area.....	0.921	0.89
Internal diameter of chest.....	Transverse diameter of heart...	0.882	0.75
Age.....	Cardiac area.....	0.872	0.81
Weight.....	Transverse diameter of heart...	0.848	0.80
Height × internal diameter of chest....	Transverse diameter of heart...	0.847	....
Body surface area.....	Transverse diameter of heart...	0.838	0.78
Height.....	Transverse diameter of heart...	0.825	0.73
Age.....	Transverse diameter of heart...	0.746	....

* Calculated from 1,026 measurements made from roentgenograms of 38 boys and 29 girls.

TABLE 2.—*Ratio of the Internal Diameter of the Chest to the Total Transverse Diameter of the Heart**

Age	No. of Cases	Mean ± SEm	σ ± SEσ	Mean ± 2σ	Actual Range
0-1 yr.	357	2.03 ± 0.008	0.1513 ± 0.00566	1.73-2.33	1.53-2.57
1-2 yr.	211	2.14 ± 0.010	0.1510 ± 0.00740	1.84-2.44	1.69-2.55
2-3 yr.	183	2.20 ± 0.010	0.1385 ± 0.00720	1.92-2.48	1.85-2.52
3-4 yr.	152	2.19 ± 0.009	0.1150 ± 0.00660	1.96-2.42	1.94-2.53
4-5 yr.	87	2.22 ± 0.012	0.1187 ± 0.00900	1.98-2.58	1.90-2.51
5-6 yr.	33	2.24 ± 0.020	0.1145 ± 0.01400	2.01-2.47	2.00-2.51
0-6 yr.	1,023	2.13 ± 0.005	0.1625 ± 0.00360	1.81-2.45	1.53-2.57

* Calculated in centimeters from 1,023 measurements made from roentgenograms of 38 boys and 29 girls. The arithmetical mean, standard deviation, range included within plus and minus two standard deviations from the mean and actual range of values for each age group are given.

Since the ratio $\frac{\text{internal diameter of the chest}}{\text{transverse diameter of the heart}}$ is so frequently used in estimating the normality of cardiac size, we have calculated these values for our series. In table 2 are shown the means, the standard deviations, the ranges included within plus and minus two standard deviations from the means and the actual ranges for the children in this study, divided according to age in years.

Transverse Diameter Heart in cm.

Cardiac Area in sq cm.

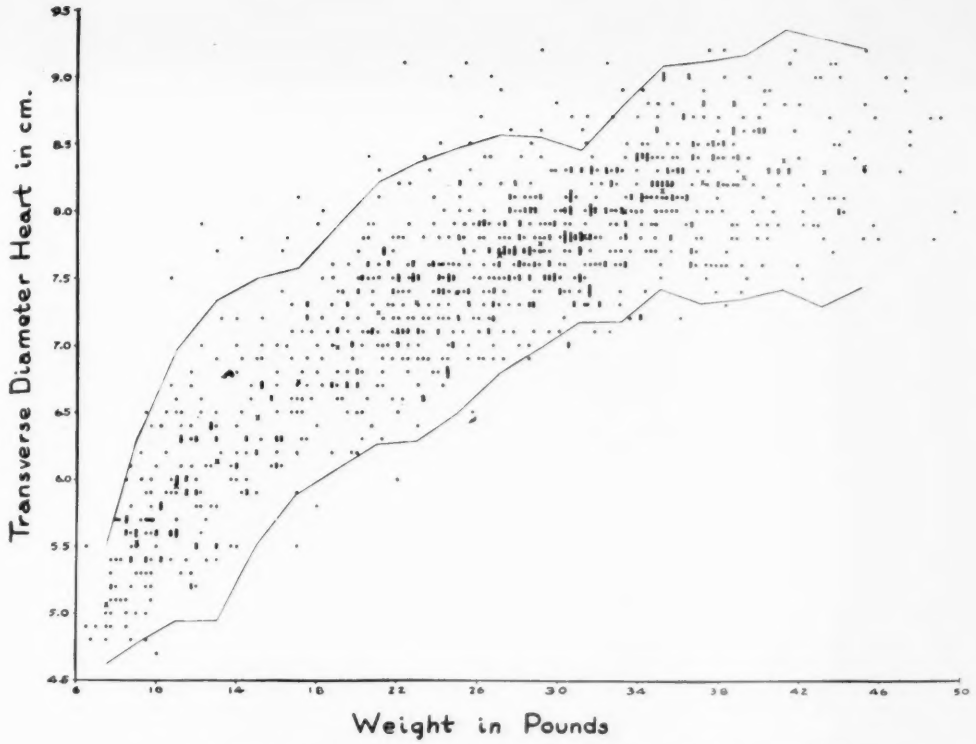

Fig. 5.—Scatter diagram of 1,024 measurements of the total transverse diameter of the heart in centimeters referred to weight in pounds. The crosses represent the mean for each weight interval. The region between the lines is within the range of plus and minus two standard deviations from the mean.

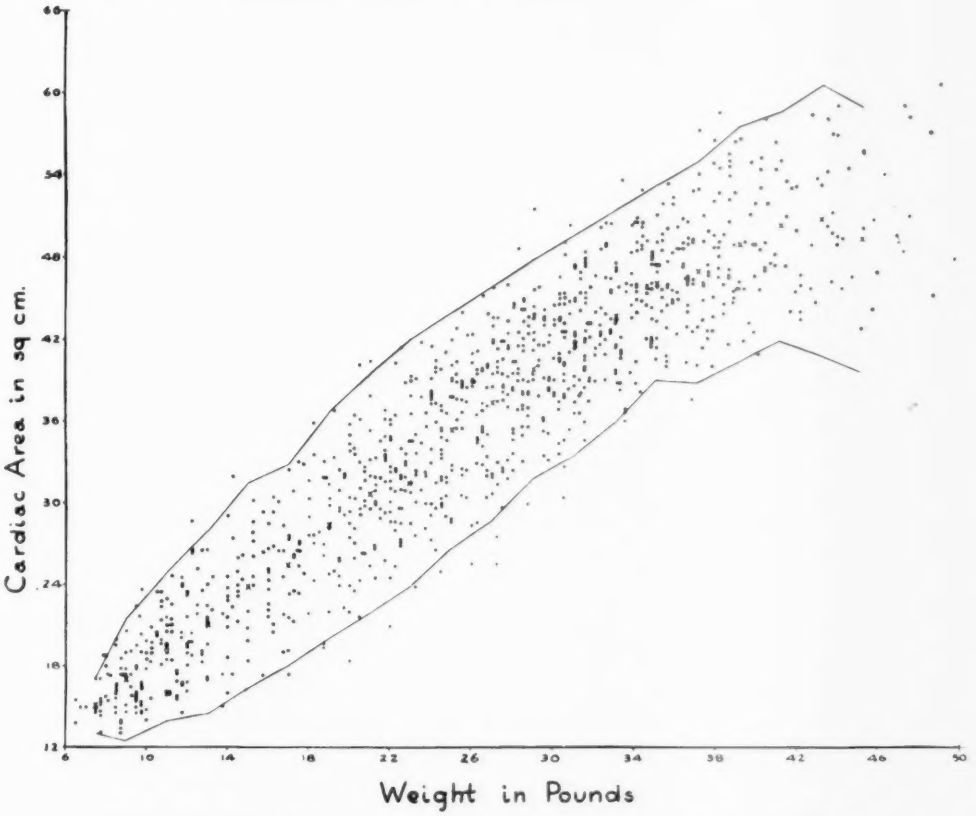

Fig. 6.—Scatter diagram of 1,025 measurements of cardiac area in square centimeters referred to weight in pounds. The crosses represent the mean for each weight interval. The region between the lines is within the range of plus and minus two standard deviations from the mean.

Fig. 7.—Scatter diagram of 1,026 measurements of cardiac area in square centimeters referred to height in centimeters × internal diameter of the chest in centimeters. The crosses represent the mean for each class interval of the factor height × internal diameter of the chest. The region between the lines is within the range of plus and minus two standard deviations from the mean.

Fig. 8.—Scatter diagram of 1,025 measurements of cardiac area in square centimeters referred to body surface area in square meters. The crosses represent the mean for each class interval of body surface area. The region included between the lines is within the range of plus and minus two standard deviations from the mean.

COMPARISON WITH QUOTIENTS OF JOSEPHI AND OF VON BERNUTH

Our data were checked against those of von Bernuth and of Josephi, the two quotients which they suggested being used. The relations between cardiac area and height × internal diameter of chest and between cardiac area and body surface area are shown graphically on the two scatter charts in figures 7 and 8. Von Bernuth's ratio of $\frac{\text{height} \times \text{internal diameter of chest}}{\text{cardiac area}}$ gives normal values of 31 to 47 for children over 1 year of age and of 29 to 44 for smaller children. Of the values in our series, 93.5 per cent were within the limits set by von Bernuth as normal, 3.7 per cent were above those limits and 2.7 per cent were below. From our data the mean was calculated as 37.80 ± 0.1473, with a standard deviation of 4.71 ± 0.1042. The mean plus and minus two standard deviations gives a range of from 28.38 to 47.22 for the entire six year period, essentially the range given by von Bernuth.

Josephi's ratio of $\frac{\text{body surface area}}{\text{cardiac area}}$ gives for his data a range of from 11.5 to 15.5 for the mean plus and minus two standard deviations. In our series, 73.6 per cent of the values fell within that range, 22.4 per cent were above the limits set as normal, and 4 per cent were below. However, our data give a mean value of 14.22, as opposed to Josephi's mean of 13.5. With the range for our data set within plus and minus two standard deviations from the mean, the limits would be 10.5 and 17.9; they would include 96.8 per cent of our values, with 2.4 per cent above and 0.78 per cent below the range.

Both Josephi and von Bernuth concluded that their quotients would run lower for younger children. The number of their subjects in the younger group was, however, too small to permit conclusions. Since most of the children in the present study were under 4 years of age, the age groups were studied statistically, as shown in table 3.

It is evident from inspection of this table that in the first year of life the range is greater than at any other age and that the standard deviation is higher. The means are approximately the same in the first three years of life for Josephi's quotient, but for von Bernuth's quotient they are lower in the first year than at any other age. Thus there is considerably more variation in the measurements of the size of the heart during early infancy than there is later. It is possible that measurements taken during this period are not a true indication of cardiac size, since the shadow of the thymus interferes in many instances with accurate delineation of the cardiac borders near the base of the heart. In the figures for von Bernuth's quotient (table 3), not only is the mean progressively increased with advance in age but the figures representing the lower limits of the range are higher for each age group from the first to the sixth year.

Since it is true that most of our values fall within the limits set as normal for both quotients, the quotients proposed can probably be applied to the early age periods. Our work indicates that the range

TABLE 3.—*Results of Statistical Analysis of Values Compiled from the Original Data for the Quotients Suggested by Josephi and by von Bernuth* *

Age	No. of Cases	Mean ± SEm	σ ± SEσ	Percentage of Subjects with Values Within Range	Percentage of Subjects with Values Below Range	Percentage of Subjects with Values Above Range	Actual Range
			Josephi's Quotient [5]				
0-1 yr.	358	14.04±0.1247	2.36±0.0880	68.7	8.6	22.6	8.6-20.6
1-2 yr.	209	14.03±0.1211	1.75±0.0858	74.2	4.3	21.5	10.7-19.7
2-3 yr.	183	14.06±0.0932	1.26±0.0661	85.8	0.5	13.7	10.7-17.6
3-4 yr.	152	14.24±0.0990	1.22±0.0702	82.9	...	17.1	11.8-17.7
4-5 yr.	87	15.02±0.1438	1.34±0.1022	63.2	...	36.8	12.2-18.1
5-6 yr.	33	15.95±0.2840	1.63±0.2037	39.4	...	60.6	13.2-19.4
0-6 yr.	1,022	14.22±0.0575	1.84±0.0410	73.6	4.0	22.4	8.6-20.6
			von Bernuth's Quotient [2]				
0-1 yr.	358	35.87±0.2706	5.12±0.1920	87.7	5.3	7.0	19.9-52.7
1-2 yr.	210	37.64±0.3170	4.59±0.2245	93.8	3.8	2.4	28.1-49.0
2-3 yr.	183	38.49±0.2611	3.53±0.1851	98.9	0.5	0.5	29.6-48.7
3-4 yr.	152	39.16±0.2476	3.05±0.1756	100.0	...	....	32.3-46.7
4-5 yr.	87	40.42±0.3283	3.06±0.2334	97.7	...	2.3	34.3-48.6
5-6 yr.	33	42.75±0.7178	4.12±0.5150	84.8	...	15.1	35.8-50.0
0-6 yr.	1,023	37.80±0.1473	4.71±0.1042	93.5	2.7	3.7	19.9-52.7

* With reference to the percentage of cases included within their ranges of normality and showing the actual range of values for the 38 boys and 29 girls of this study.

TABLE 4.—*Comparison of the Values of the Child Research Council With Those of Josephi and von Bernuth* *

	Body Surface Area			
		Cardiac Area		
Source of Data	Mean ± 2σ	Mean	No. of Subjects	Age
Josephi	11.5-15.5	13.5	418	2-14 years
C.R.C.	10.5-17.9	14.22	1,022	0- 6 years
	Height × Internal Diameter of Chest			
		Cardiac Area		
Source of Data	Mean ± 2σ	Mean	No. of Subjects	Age
von Bernuth	26.6-48.9	36.5	13	0-10 months
C.R.C.	25.6-46.1	35.9	358	0- 1 year
von Bernuth	29.6-48.9	39.3	200	1-16 years
C.R.C.	30.0-46.8	38.8	665	1- 6 years

* Values for the mean and the range included within plus and minus two standard deviations from the mean for the quotients suggested by Josephi [5] and von Bernuth [2] calculated from measurements of roentgenograms of 38 boys and 29 girls compared with the same values for Josephi's and von Bernuth's data.

proposed by Josephi is too small for the period of life up to the age of 6 years. The comparison of our values for these two quotients with the previous data presented by Josephi and by von Bernuth is shown in table 4. Von Bernuth's range of normality (29 to 44 for infants and 31 to 47 for older children) was calculated on the basis of 80 to 120 per cent of the mean. For purposes of comparison with our work, his data were recalculated, the range corresponding to plus and minus two standard deviations from the mean.

TABLE 5.—*Individual Measurements on Boys* *

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
1		1	52.50	7.75	0.215	1+	5.3	10.2	17.1	22.8
		2	58.00	9.75	0.255	1+	6.4	11.8	15.4	25.4
		3	62.25	11.25	0.285	2+	6.5	12.6	18.5	30.0
		6	69.25	15.00	0.350	2+	6.9	13.3	20.8	41.5
		9	71.25	17.25	0.380	2+	6.6	13.9	23.6	53.7
	1		76.50	19.50	0.420	1+	7.6	14.8	25.8	52.4
	1	3	78.00	20.75	0.435	0	7.1	14.6	26.3	58.2
	1	6	82.00	22.25	0.465	1+	7.3	15.2	30.9	70.5
	1	9	84.25	23.00	0.480	1+	6.9	15.5	28.5	81.8
	2		88.00	24.50	0.510	3+	7.3	15.7	31.9	83.1
	2	3	90.75	26.25	0.540	2+	8.0	15.6	34.7	71.0
	2	6	93.00	26.75	0.550	2+	7.5	15.8	40.2	100.4
	2	9	94.25	28.25	0.570	3+	7.8	17.2	41.5	112.8
	3		95.75	29.00	0.580	4+	7.8	17.0	45.7	123.6
	3	3	98.25	31.00	0.615	4+	8.6	17.4	47.3	120.2
	3	6	100.25	31.25	0.625	3+	8.5	17.5	44.1	117.2
	3	9	102.25	33.75	0.655	3+	8.2	18.3	46.8	136.2
	4		104.00	34.25	0.670	4+	8.8	17.4	50.2	124.3
	4	3	106.50	36.50	0.700	4+	8.4	17.8	48.9	134.7
2		1	54.75	8.50	0.230	3+	6.0	11.0	20.0	29.6
		2	57.50	10.50	0.265	1+	6.5	12.5	20.5	35.0
		3	61.75	12.75	0.300	2+	6.4	12.0	18.3	35.7
		6	68.75	16.75	0.360	2+	7.3	14.6	24.6	46.9
		9	71.25	21.25	0.410	2+	7.7	14.8	31.9	53.5
3		1	54.50	9.00	0.235	3+	5.6	10.3	20.6	22.3
		2	59.75	12.25	0.290	2+	5.6	11.1	20.4	26.7
		3	62.00	13.75	0.310	2+	6.1	12.0	21.9	37.8
		5½	67.00	17.00	0.360	3+	6.2	13.2	27.3	51.5
		9	71.50	20.00	0.400	3+	6.8	14.7	28.5	68.8
	1		73.75	21.75	0.430	3+	7.4	15.6	33.5	75.7
	1	3	79.50	24.25	0.470	3+	6.9	15.5	31.5	78.9
	1	6	81.50	25.50	0.490	3+	6.9	16.3	32.1	90.5
	1	9	85.50	27.25	0.520	4+	6.9	15.7	31.3	92.3
	2		89.00	28.00	0.540	4+	7.0	16.8	34.7	102.3
	2	3	90.50	29.75	0.565	4+	8.0	17.5	38.3	105.1
	2	6	93.00	31.00	0.585	4+	8.3	18.3	47.2	134.7
	2	9	96.75	31.50	0.610	4+	8.4	18.3	47.9	129.3
	3		97.50	31.50	0.615	4+	8.3	18.8	47.6	143.2
	3	3	99.75	34.75	0.650	3+	8.0	17.8	42.0	118.4
	3	6	102.25	34.50	0.660	4+	8.4	18.7	45.9	134.3
4		2	60.00	12.50	0.290	4+	7.7	12.0	33.8	33.1
		3	63.50	15.25	0.315	3+	7.7	12.7	36.7	33.1
		4½	67.50	19.25	0.380	2+	8.5	13.0	41.8	26.0
		8	72.00	24.00	0.440	2+	7.8	14.9	42.2	56.2
		10	75.00	26.00	0.465	2+	8.2	14.7	43.0	58.5
	1	½	79.00	27.00	0.490	4+	7.9	15.0	39.1	63.0
	1	4	81.50	31.75	0.540	2+	7.5	16.4	41.0	90.5
	2	4	92.00	32.00	0.590	4+	7.3	17.7	46.7	124.3
	2	7	94.25	33.00	0.610	4+	7.8	17.7	47.6	124.3
	3		96.50	34.00	0.635	4+	7.2	17.4	46.0	124.3
	3	10	104.00	38.00	0.695	4+	8.0	18.2	58.5	149.4
	4	1	105.75	38.25	0.710	4+	7.3	17.4	49.7	132.8
	4	4	108.00	39.00	0.720	4+	7.4	18.0	45.7	135.1
	4	7	109.50	40.25	0.740	4+	8.3	17.9	51.8	153.8
5		2	60.00	12.75	0.295	3+	5.8	12.4	18.9	39.2
		4	65.00	15.00	0.330	2+	6.2	13.3	22.1	42.7
		4½	66.00	15.75	0.345	2+	6.6	14.0	29.3	57.8
		7	69.50	19.00	0.385	2+	7.1	14.7	31.4	53.7
		10½	73.00	23.00	0.430	3+	7.1	15.4	30.8	75.6
	1	1½	78.50	26.25	0.485	3+	7.6	16.3	36.5	90.6
	1	5	82.00	27.75	0.510	1+	8.1	17.0	41.5	87.4
	1	7	86.50	28.25	0.540	1+	8.0	16.4	39.9	79.8
	1	11	88.50	29.50	0.560	3+	7.5	17.4	35.3	117.6
	2	1½	92.50	30.50	0.580	3+	8.3	16.5	42.6	93.6
	2	8	97.66	37.00	0.660	4+	7.8	17.8	40.2	120.4
	2	10	98.25	35.00	0.655	4+	8.1	18.8	41.4	137.4
	3	1	100.75	37.50	0.675	3+	8.5	19.4	46.9	151.3
	3	5	101.50	38.00	0.685	4+	8.5	19.3	48.7	153.2
	3	8	106.00	38.75	0.710	4+	8.3	18.8	45.5	141.0
	4	2	110.00	41.50	0.750	4+	8.6	19.4	44.0	145.9
6		1	59.50	12.25	0.285	2+	5.8	12.0	19.8	33.1
		2	62.50	15.00	0.325	2+	6.2	12.8	18.4	40.1
		6	73.00	22.00	0.425	2+	6.5	14.1	21.0	56.2
		10	77.00	26.00	0.475	2+	7.1	14.8	25.6	63.1
	1		79.50	27.75	0.500	2+	7.7	17.0	33.2	89.1
	1	3	85.00	30.50	0.550	2+	7.0	16.4	32.7	90.7
	1	6	88.00	31.75	0.570	1+	8.0	17.7	37.5	92.2
	1	9	91.00	33.75	0.600	1+	8.3	17.7	39.7	83.9
	2	6	99.00	36.75	0.660	3+	8.0	17.9	37.7	109.1
	2	9	102.75	37.50	0.690	3+	8.4	17.6	42.7	127.4

* Ht. indicates height; Wt., weight; B.S.A., body surface area; Deg. of Insp., degree of inspiration (explained in text); T.D., total transverse diameter of heart; I.D., internal diameter of chest; C.S.A., cardiac surface area, and L.S.A., lung surface area.

TABLE 5.—*Individual Measurements on Boys*—Continued*

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
7		1	57.50	11.00	0.270	1+	6.0	11.2	21.6	23.8
		2	61.00	13.00	0.300	2+	6.9	12.5	26.6	31.4
		2½	62.00	14.00	0.315	1+	7.2	13.9	29.1	36.0
		6	71.00	20.00	0.400	2+	7.4	14.5	35.0	52.0
		9	73.00	22.50	0.430	2+	7.5	15.6	34.0	74.4
	1		77.50	24.50	0.465	2+	7.8	15.8	35.5	71.4
	1	3	81.50	26.50	0.500	0	8.4	16.5	39.9	72.3
	1	6	83.50	27.25	0.515	2+	7.7	15.8	40.0	90.4
	1	9	87.50	29.75	0.555	1+	8.8	16.4	42.3	81.6
	2		92.00	32.25	0.590	3+	9.1	18.0	50.2	106.1
8		1	53.50	8.50	0.230	3+	5.6	10.8	19.5	26.5
		2	57.00	10.75	0.265	3+	5.9	11.6	19.7	32.4
		3	59.50	11.75	0.280	3+	6.1	12.4	20.5	38.7
		6	66.50	16.00	0.350	1+	6.3	13.8	22.6	46.0
		10	72.00	19.50	0.400	3+	7.1	15.1	29.4	61.6
	1		74.00	20.75	0.420	2+	7.5	15.5	32.7	59.0
	1	3	76.00	23.00	0.445	4+	6.4	16.0	31.5	94.8
	1	6	80.00	23.75	0.470	4+	6.8	15.6	32.0	94.2
	1	9	83.00	25.75	0.500	3+	7.9	16.7	42.3	78.2
	2		86.00	27.00	0.520	4+	7.8	16.8	43.0	90.9
	2	3	87.50	28.00	0.540	4+	7.5	16.7	44.3	96.5
	2	6	91.00	30.25	0.570	4+	7.6	16.6	43.4	101.3
	2	9	93.00	31.25	0.590	4+	7.9	18.1	46.4	106.2
	3		95.50	32.50	0.615	3+	8.3	18.4	43.8	106.8
	3	3	97.25	33.75	0.635	4+	8.4	18.6	48.3	129.7
	3	6	98.75	35.75	0.660	4+	8.3	18.7	48.3	129.2
	3	9	101.50	37.00	0.680	4+	8.9	19.4	54.1	131.7
	4		104.00	37.75	0.695	4+	8.7	19.0	52.1	140.0
	4	3	105.25	40.00	0.720	4+	8.6	19.1	53.0	143.7
9		1	50.00	7.00	0.200	3+	4.9	9.9	15.0	25.6
		2	54.50	9.66	0.245	2+	5.7	11.9	21.7	36.7
		3	57.00	10.75	0.265	1+	5.6	12.1	22.4	31.9
		6	63.50	13.00	0.310	0	6.5	12.9	24.1	36.5
		9	68.00	16.00	0.355	1+	6.1	13.6	24.3	52.1
	1	1	74.00	19.75	0.410	3+	6.9	15.3	32.1	67.0
	1	3	75.50	22.00	0.440	2+	7.1	15.2	31.7	65.8
	1	6	79.50	23.00	0.460	2+	7.5	15.5	37.9	68.8
	1	9	81.75	25.25	0.490	2+	7.1	16.1	37.7	80.4
	2		85.00	26.50	0.515	2+	7.7	16.3	37.3	86.0
	2	3	87.50	28.50	0.540	1+	8.0	17.0	41.6	85.5
10		1½	55.00	10.25	0.250	4+	5.8	11.9	18.3	39.0
		2½	59.50	12.00	0.285	4+	6.3	12.5	23.5	40.1
		4	63.50	14.50	0.320	4+	6.2	13.3	26.0	60.3
		7	69.00	19.00	0.380	3+	6.7	14.2	24.8	62.2
		10	74.00	21.50	0.425	4+	7.0	16.0	28.9	89.7
	1	1	78.50	24.50	0.470	4+	6.8	16.2	31.7	107.1
	1	5	81.50	25.75	0.495	3+	7.2	15.5	32.4	79.5
	1	8	86.00	27.75	0.530	3+	7.7	15.8	38.1	90.0
	1	11	87.00	30.50	0.560	3+	7.7	16.3	34.7	93.3
	2	2	88.50	31.25	0.570	4+	7.6	17.0	39.1	112.5
	2	4	90.50	31.50	0.580	4+	7.4	17.4	36.0	135.5
	2	8	93.50	31.25	0.595	4+	7.5	17.4	45.4	136.0
	2	11	96.50	34.25	0.635	4+	7.7	17.7	38.2	124.1
	3	1½	97.00	34.00	0.635	4+	8.1	17.6	45.8	132.8
	3	4½	100.75	35.00	0.660	4+	8.2	18.0	46.9	129.9
	3	7½	102.25	37.50	0.685	4+	8.5	18.3	46.7	139.8
	3	10½	104.75	38.00	0.700	4+	8.5	18.9	52.7	162.3
	4	3	107.50	38.00	0.715	4+	8.2	17.4	46.5	141.3
11		1	52.50	8.50	0.225	3+	4.9	9.9	15.7	24.1
		3	57.50	10.75	0.270	2+	5.6	11.5	20.0	32.6
		6	63.50	14.50	0.320	0	6.3	12.4	24.0	36.8
		9	66.50	15.25	0.340	0	6.7	12.4	24.0	30.7
	1		70.00	20.00	0.395	0	6.7	13.0	24.0	43.8
	1	3	74.25	20.25	0.420	0	7.0	13.5	28.2	45.1
12		1	53.50	9.50	0.240	3+	5.6	11.7	19.6	31.8
		1½	55.00	10.00	0.250	3+	5.6	11.9	19.9	34.0
		6	63.00	14.50	0.320	1+	5.9	13.0	23.2	41.6
		10	68.00	17.25	0.365	1+	6.8	14.2	30.9	51.4
	1		72.00	19.25	0.400	2+	7.2	14.6	36.8	64.5
	1	3	74.50	21.00	0.425	3+	7.1	16.0	33.2	78.8
	1	7	79.00	22.25	0.455	1+	7.1	15.3	32.4	70.9

TABLE 5.—*Individual Measurements on Boys*—Continued*

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
13		1	52.50	8.00	0.220	2+	5.2	10.6	15.8	21.4
		2	56.00	10.00	0.250	2+		11.8	17.8	27.0
		3	59.00	11.50	0.280	1+	5.9	12.5	17.7	30.1
		6	68.00	18.50	0.375	1+	7.1	15.2	27.9	47.9
		9	70.50	22.00	0.415	1+	7.5	16.6	30.1	70.8
	1		76.50	24.50	0.460	0	7.6	16.8	30.0	65.5
	1	3	78.50	26.25	0.480	3+	7.8	17.6	39.5	90.8
	1	6	82.50	28.50	0.510	2+	8.2	18.0	45.0	98.5
	1	9	85.50	28.50	0.530	3+	7.5	17.2	35.7	93.3
	2		88.00	31.00	0.560	2+	7.5	17.0	36.7	92.0
	2	3	90.50	32.25	0.585	3+	8.0	18.3	42.3	124.9
	2	6	93.00	32.75	0.600	2+	8.2	16.8	45.4	92.4
	2	9	95.50	34.50	0.625	3+	8.2	18.4	49.2	126.9
	3		97.00	35.25	0.640	3+	8.3	17.4	49.2	122.4
	3	3	97.00	36.75	0.655	4+	8.5	18.5	49.1	130.5
	3	6	102.25	38.50	0.690	4+	8.4	18.1	46.7	126.4
	3	9	104.00	38.75	0.700	4+	8.4	18.3	48.9	132.9
14		1	54.00	8.75	0.230	2+	5.6	10.6	14.0	23.0
		2	59.00	12.75	0.290	2+	6.1	11.8	19.2	31.7
		7½	73.50	21.25	0.420	1+	7.7	15.4	26.7	51.9
		9½	73.75	21.25	0.425	1+	7.7	14.8	33.3	49.1
	1		76.00	27.25	0.480	2+	7.1	15.2	25.6	62.3
	1	3	79.50	27.25	0.500	2+	7.5	15.8	27.6	71.3
	1	6½	81.50	29.75	0.525	3+	7.5	17.3	33.2	93.4
	1	10	87.50	30.75	0.560	2+	7.8	17.8	35.4	103.1
	2		89.50	32.00	0.580	2+	8.2	17.9	41.4	106.1
	2	3	91.50	31.00	0.580	2+	8.3	17.7	42.3	96.4
	2	6	93.75	34.25	0.620	1+	8.4	19.2	48.8	125.2
	2	9	95.50	33.75	0.625	3+	8.7	19.1	50.3	130.6
	3		97.25	36.00	0.650	1+	8.7	18.9	48.6	127.0
15		1	53.00	8.75	0.230	2+	5.4	11.1	17.4	29.4
		2	58.50	11.75	0.280	4+	5.2	11.9	20.2	44.9
		4	63.75	14.00	0.320	2+	6.0	13.3	20.9	49.0
		6	66.50	16.00	0.350	2+	6.3	13.8	25.2	52.9
		8	69.00	18.00	0.375	3+	6.8	15.0	27.7	66.9
		11	73.50	21.00	0.420	1+	6.7	14.7	25.4	61.3
	1	2	76.50	22.50	0.445	1+	7.0	15.2	27.2	62.6
	1	5	78.50	23.50	0.460	3+	7.3	16.5	34.4	92.1
	1	7	82.00	24.25	0.480	2+	7.2	15.8	36.0	86.2
	2		85.00	26.75	0.520	3+	7.4	17.0	37.2	107.4
	2	3	87.50	26.75	0.525	3+	7.0	16.9	35.1	118.4
	2	6	89.50	28.75	0.555	2+	7.6	17.2	39.0	118.6
	2	8	91.00	29.75	0.575	2+	7.9	17.1	41.8	105.9
	3		93.00	30.50	0.585	3+	8.1	16.9	45.0	116.1
	3	3	96.00	31.75	0.610	3+	8.3	16.6	45.8	104.2
	3	6	97.25	34.00	0.640	4+	8.4	17.6	49.1	123.1
16		1	55.75	9.25	0.240	2+	6.2	11.8	19.1	23.4
		2	58.25	11.25	0.275	2+	6.3	12.0	21.1	35.4
		3	61.00	12.25	0.290	2+	7.9	13.9	26.6	43.1
17		1	55.25	9.50	0.245	3+	5.3	11.6	14.6	31.7
		2	56.50	11.75	0.270	2+	5.3	13.2	16.7	36.7
		4	62.75	13.00	0.310	3+	5.5	13.2	17.2	54.2
		7	69.50	18.00	0.380	3+	5.8	14.9	21.9	71.5
		9	72.00	20.00	0.410	1+	6.5	14.2	22.1	55.7
	1		74.50	22.50	0.440	1+	6.9	15.4	28.6	76.2
	1	4	79.00	23.25	0.460	3+	6.9	16.0	27.7	97.5
	1	7	81.25	25.00	0.490	3+	7.2	16.2	32.4	96.5
18		½	53.00	7.75	0.220	4+	5.0	10.1	14.3	27.6
		1½	56.50	9.00	0.240	4+	5.3	11.1	17.4	37.5
		2½	59.50	10.75	0.275	4+	6.0	12.1	21.4	39.3
		6	67.00	15.25	0.340	3+	6.7	13.6	26.1	49.9
		9	71.00	18.75	0.390	3+	6.7	15.3	31.9	75.4
	1		74.00	21.75	0.430	1+	7.1	15.3	33.3	62.5
	1	3	78.50	24.50	0.470	1+	7.5	16.1	36.8	64.1
	1	9	84.00	26.25	0.510	2+	7.3	16.1	32.9	79.3
	2		85.25	26.50	0.520	3+	7.1	15.5	35.4	91.4
	2	3	89.50	28.50	0.550	3+	7.3	15.3	37.2	81.7
	2	6	90.75	29.50	0.560	3+	7.8	16.1	44.2	106.9
	2	9	93.00	31.50	0.590	4+	8.0	17.7	45.4	118.0
	3		94.25	32.75	0.610	4+	7.6	18.1	43.5	146.7
	3	3	97.75	33.75	0.640	3+	8.0	17.9	44.5	113.7
	3	9	100.25	36.50	0.670	4+	8.2	18.3	49.3	140.5
19		1	55.25	9.75	0.250	3+	5.3	9.8	14.7	24.4
		2	60.50	11.00	0.280	3+	5.9	11.0	16.1	30.1
		3	61.75	12.25	0.295	3+	6.5	12.4	19.8	33.6
		6	69.00	17.50	0.370	1+	7.2	14.3	25.4	44.3
		9	74.50	20.50	0.420	2+	7.5	13.8	21.7	44.0
	1		77.00	22.50	0.450	1+	7.6	14.3	29.7	48.3
	1	3	81.00	24.75	0.480	3+	7.5	14.5	31.5	59.9
	1	8	86.00	28.00	0.550	2+	8.0	14.8	33.7	58.4
	1	9	87.50	29.00	0.545	4+	7.9	16.1	42.5	93.6
	2		90.00	29.75	0.560	4+	7.5	16.5	38.5	108.9
	2	3	92.50	30.25	0.580	4+	7.8	16.7	43.5	112.1
	2	6	94.50	32.50	0.610	4+	8.1	17.1	50.5	130.1
	2	9	98.25	34.75	0.650	4+	7.9	17.5	44.3	130.6
	3		99.50	34.75	0.655	4+	8.3	17.5	48.3	121.1
	3	3	101.00	35.50	0.660	4+	8.3	17.7	53.3	125.8
	3	6	104.75	37.25	0.695	4+	8.3	17.2	51.0	124.5
	3	9	106.50	38.50	0.710	4+	8.5	18.0	55.5	147.6

TABLE 5.—*Individual Measurements on Boys*—Continued*

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
20		2	59.50	11.00	0.275	2+	5.7	12.1	16.0	33.4
		3	63.50	14.00	0.320	1+	6.4	13.4	16.1	37.2
		6	64.75	16.75	0.350	1+	6.9	13.9	21.8	49.3
		9	73.00	19.00	0.400	0	7.4	14.6	22.1	45.8
	1		77.00	22.25	0.445	1+	7.8	16.0	28.1	73.2
	1	3	80.00	24.25	0.475	0	7.6	16.0	26.6	59.4
	1	6	84.50	.....	.....	0	8.3	15.1	27.3	47.6
	1	8	85.50	26.25	0.520	3+	7.9	16.3	39.8	84.9
	2	3	92.00	30.50	0.580	2+	8.1	16.9	38.0	82.7
	3	1	100.25	33.50	0.650	1+	8.1	15.8	36.7	84.5
	3	4	103.00	36.50	0.680	3+	7.9	16.3	40.3	102.9
	3	6	103.50	37.50	0.690	3+	8.4	17.9	47.4	126.1
	3	10	106.50	38.50	0.710	4+	8.2	17.8	47.1	135.2
	4	1	107.75	39.00	0.720	3+	8.6	18.1	46.2	126.4
	4	5	110.25	40.75	0.750	4+	7.9	17.9	47.3	156.4
	4	8	112.00	41.75	0.765	3+	8.4	19.1	49.9	151.3
	4	10	112.50	41.75	0.770	4+	7.6	18.1	45.4	171.4
	5	1	114.25	42.50	0.790	4+	8.1	18.1	48.8	162.4
	5	4	116.00	40.50	0.780	4+	8.0	18.4	47.5	164.9
	5	6	117.25	43.50	0.810	4+	7.7	18.4	46.2	179.2
	5	9	119.75	46.75	0.840	4+	8.3	18.1	49.1	157.1
21		1	51.25	6.75	0.200	1+	4.8	9.7	15.0	21.1
		1½	54.00	9.25	0.235	1+	5.3	10.4	16.5	22.4
		2½	59.00	11.50	0.280	1+	5.4	11.0	15.8	29.5
		5½	66.50	16.00	0.350	1+	6.1	12.6	21.7	36.7
		9	71.25	20.25	0.405	2+	6.3	14.5	26.0	70.6
	1		75.00	22.25	0.440	1+	6.6	14.5	28.7	67.1
	1	3	80.00	24.75	0.480	1+	7.0	15.7	34.6	93.0
	1	6	82.00	24.50	0.485	3+	6.8	16.2	33.6	105.1
	1	9	85.50	26.50	0.520	3+	7.1	16.6	32.8	107.7
	2		86.50	25.75	0.520	2+	6.5	16.6	30.4	106.7
	2	6	91.50	28.50	0.560	2+	7.3	17.1	35.0	115.0
	3		94.25	30.75	0.595	3+	7.3	17.3	38.4	127.2
22		2	55.00	10.25	0.250	3+	5.4	10.4	19.4	28.4
		3	58.50	13.00	0.290	3+	5.8	11.7	21.3	33.5
		6	68.00	17.75	0.370	1+	6.6	13.3	24.8	43.8
		9	70.50	19.75	0.400	1+	6.2	13.6	22.3	50.7
	1		75.00	22.50	0.440	2+	6.8	14.7	31.0	69.7
	1	3	78.25	24.50	0.470	1+	7.0	14.9	30.3	64.5
23		1	52.00	8.50	0.225	4+	5.0	9.6	14.6	28.4
		2	55.50	9.75	0.250	4+	5.6	10.8	19.1	35.8
		3	57.50	11.25	0.270	4+	6.1	11.5	21.5	40.0
		6	64.00	16.00	0.340	2+	6.7	12.8	24.9	38.2
		9	69.75	22.00	0.410	3+	7.4	14.6	29.4	57.7
	1		73.50	23.75	0.440	2+	7.6	14.8	30.0	55.3
	1	4	79.50	26.25	0.490	1+	7.9	15.3	34.8	59.9
	1	6	80.50	28.50	0.510	2+	8.1	16.1	36.9	68.8
	1	9	82.00	29.00	0.520	3+	8.1	16.8	43.6	88.1
	2		86.00	29.75	0.545	3+	8.3	16.3	39.1	76.9
	2	2½	88.50	30.25	0.560	4+	8.0	17.6	44.6	129.8
	2	5½	91.00	34.25	0.600	4+	8.5	17.9	48.6	123.4
	2	9	93.00	35.50	0.625	4+	8.1	17.8	44.5	131.3
	3		95.00	36.00	0.640	4+	8.3	17.5	48.6	125.4
	3	3	97.50	36.25	0.655	4+	8.1	18.4	50.8	151.0
	3	7	101.00	38.50	0.685	4+	8.6	18.7	53.9	146.4
	3	9	102.25	38.50	0.690	4+	8.6	18.3	52.2	148.0
	4		104.00	40.25	0.715	4+	8.9	19.1	58.1	154.1
	4	2½	106.00	39.50	0.720	4+	8.2	19.0	51.1	159.2
	4	6	108.00	42.50	0.750	4+	9.0	19.3	58.3	159.6
	4	9	110.50	43.50	0.770	4+	9.1	19.7	56.9	179.1
	5		111.75	43.75	0.780	4+	9.0	19.1	59.0	177.2
	5	2½	112.25	43.75	0.785	4+	8.5	18.4	56.8	170.0
	5	5	109.75	47.00	0.785	4+	9.0	19.7	58.9	176.2
	5	8	112.25	48.25	0.815	4+	8.7	18.6	57.0	171.0
24		1	54.00	8.75	0.230	1+	5.5	10.8	13.4	25.5
		2	55.00	11.00	0.260	2+	5.6	10.9	18.5	29.3
		6	66.50	16.75	0.355	2+	6.5	13.0	26.5	46.1
		9	71.00	18.00	0.380	2+	6.4	13.0	29.0	53.4
	1		75.00	19.75	0.415	1+	7.0	14.9	32.0	60.6
	1	3	78.50	21.50	0.445	2+	7.3	14.7	34.6	70.2
	1	6	80.50	23.00	0.465	3+	7.0	15.0	36.6	80.8
	1	9	84.00	24.00	0.490	4+	7.3	15.8	37.3	99.0
	2		87.00	26.00	0.520	3+	7.9	14.9	41.0	71.7
	2	3	89.25	27.50	0.540	3+	7.8	15.1	41.9	80.6
	2	6	91.25	29.25	0.565	4+	7.8	16.0	45.8	95.1
	2	9	93.50	29.00	0.570	4+	7.7	16.1	39.1	111.2

TABLE 5.—*Individual Measurements on Boys*—Continued*

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
25		2	53.50	8.75	0.230	1+	4.8	10.6	13.1	26.2
		4	60.50	14.00	0.310	1+	5.5	12.0	18.7	42.9
		10	72.50	20.50	0.415	2+	6.6	13.6	24.3	54.6
	1	1½	76.50	21.25	0.435	3+	6.7	14.2	26.9	68.5
	1	5	78.00	23.25	0.460	4+	6.6	14.7	30.1	86.2
	1	7	81.50	23.75	0.480	3+	7.2	14.8	32.1	77.7
	1	10	84.00	25.50	0.500	2+	7.3	15.0	30.6	73.6
	2	1½	86.50	28.25	0.540	3+	7.7	16.4	36.9	96.9
	2	5	89.50	30.25	0.570	3+	7.4	16.1	33.7	98.3
	2	7	91.75	31.00	0.580	3+	7.5	16.6	37.4	101.4
	2	10	93.50	31.25	0.595	2+	8.0	16.2	36.7	83.0
	3	1	95.50	33.50	0.620	3+	7.7	16.8	36.1	101.5
	3	5	97.50	35.75	0.650	3+	8.3	17.7	44.7	110.7
	3	10	101.25	37.25	0.680	1+	8.5	17.8	43.4	91.8
	4	1	104.00	38.75	0.700	4+	7.9	17.9	44.7	132.3
	4	4	106.50	39.75	0.725	3+	7.9	17.4	42.5	124.7
	4	6	107.75	42.00	0.750	4+	7.9	18.0	45.9	135.7
26		1	51.50	7.50	0.210	3+	4.9	9.4	14.8	23.3
		2	55.50	10.75	0.260	2+	5.4	10.6	18.2	28.6
		3	59.75	13.00	0.295	2+	5.4	11.2	17.0	31.2
		6	67.00	17.00	0.360	1+	5.9	12.4	19.2	41.2
		9	72.75	19.25	0.400	4+	6.6	11.0	25.1	53.4
	1		76.25	20.75	0.430	2+	6.4	14.7	26.3	71.9
	1	3	80.75	22.25	0.460	1+	7.1	15.7	32.5	77.1
	1	6½	82.50	24.25	0.485	2+	7.4	17.2	37.3	102.3
	1	10	85.00	24.50	0.500	2+	6.8	15.8	33.3	94.2
	2		86.50	26.50	0.520	2+	7.2	16.7	34.2	97.0
	2	1	89.00	26.25	0.530	2+	7.4	16.7	34.4	99.7
	2	4	91.25	27.50	0.550	1+	7.5	16.6	38.7	88.1
	2	6	92.50	27.75	0.560	2+	7.5	17.5	38.0	114.0
	2	9	94.75	30.25	0.590	2+	7.8	17.5	40.4	96.1
	3		96.00	30.50	0.600	3+	8.0	18.3	43.2	120.9
	3	3	96.25	32.25	0.620	2+	8.0	18.3	41.7	121.2
	3	6	98.75	33.50	0.640	3+	8.1	17.9	45.5	116.6
	3	9	101.50	34.75	0.660	2+	8.1	18.0	46.1	117.4
	4		102.75	35.00	0.670	3+	8.0	18.5	42.1	132.6
27		1	53.50	8.12	0.225	2+	5.7	10.5	17.4	24.2
		2	57.00	9.75	0.255	1+	5.8	11.6	15.2	32.4
		3	58.75	11.75	0.280	2+	6.7	13.3	24.6	41.4
		6	66.25	16.00	0.350	1+	6.8	13.9	26.7	47.8
28		1	51.00	8.50	0.220	2+	5.7	10.7	16.5	25.1
		2	56.00	10.25	0.255	4+	5.8	12.1	19.8	37.4
		3	56.25	12.25	0.275	2+	6.6	13.1	26.3	37.4
		6	65.50	16.25	0.345	1+	7.7	14.4	29.3	47.7
		9	68.75	18.75	0.380	2+	7.5	14.4	31.9	56.3
	1		72.50	20.25	0.410	0	7.8	15.2	36.5	54.9
	1	6	77.50	23.25	0.455	3+	7.1	16.0	35.1	86.6
	1	9	81.00	25.00	0.490	3+	7.8	17.2	39.2	103.5
	2		84.50	25.75	0.505	1+	7.7	15.7	36.5	69.1
	2	3	86.00	27.50	0.525	2+	8.0	16.7	38.2	82.9
	2	9	89.25	30.50	0.570	3+	8.3	17.9	37.8	98.9
	3		90.00	31.50	0.580	3+	7.8	17.7	40.8	115.2
	3	3	92.50	33.25	0.605	2+	8.1	18.1	38.3	110.6
	3	6	94.00	33.25	0.615	2+	7.9	18.1	38.8	113.1
	3	10	98.00	35.50	0.650	3+	8.4	18.5	46.0	121.9
	4		99.50	37.00	0.670	1+	8.8	18.3	42.9	102.3
	4	4	102.50	36.50	0.680	3+	8.5	18.2	44.0	125.7
	4	6	105.50	37.75	0.700	3+	8.1	18.4	43.7	135.0
	4	10	106.75	39.75	0.720	3+	8.6	18.5	48.9	136.4
29		1	54.00	7.75	0.220	2+	5.4	10.4	15.2	25.7
		2	57.75	9.75	0.255	2+	5.7	11.3	16.5	34.1
		3	61.75	12.25	0.295	1+	5.9	12.6	18.8	35.6
		6	68.50	17.50	0.370	2+	6.3	12.8	23.4	50.3
		9	73.25	19.50	0.410	0	6.8	14.7	24.7	54.9
	1		77.50	22.50	0.450	1+	7.4	15.5	27.3	67.1
	1	3	80.00	24.00	0.470	1+	6.8	16.0	27.3	87.7
	1	6	83.50	24.75	0.495	1+	7.1	15.9	30.5	84.1
	1	10	87.25	27.00	0.530	0	7.6	16.5	30.7	79.6
	2	11	94.50	31.50	0.600	3+	7.7	18.4	40.0	140.1
	3	2½	97.00	34.00	0.635	4+	7.9	18.2	38.8	137.6
	3	5½	99.50	35.00	0.660	4+	8.4	19.0	47.4	149.0
	3	9	101.75	35.75	0.670	4+	8.1	18.7	44.8	148.9
	4		104.00	36.75	0.690	4+	7.8	18.1	42.6	153.2
	4	3	106.50	38.00	0.710	4+	8.4	18.8	49.1	154.8

TABLE 5.—*Individual Measurements on Boys*—Continued*

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
30		1	52.50	8.25	0.220	2+	5.4	11.0	17.3	30.3
		2	59.00	10.00	0.260	2+	6.1	12.2	14.8	29.2
		3	59.50	11.00	0.275	1+	6.6	11.8	21.1	30.1
		6	66.25	16.25	0.350	1+	7.4	14.2	26.8	41.8
		10	72.25	20.75	0.415	1+	7.9	15.3	30.2	58.1
	1		74.50	20.75	0.420	0	7.4	14.6	32.3	60.1
	1	3	78.50	23.00	0.460	1+	7.1	15.5	34.6	72.0
	1	6	80.50	25.00	0.480	2+	8.0	16.3	40.2	80.6
31		½	59.50	13.00	0.295	3+	6.4	12.4	21.6	42.3
		6	66.00	18.25	0.365	4+	6.9	12.3	27.1	50.3
		8½	70.50	20.25	0.400	1+	7.1	14.5	27.1	56.9
	1		74.50	21.75	0.430	2+	7.3	15.3	33.9	74.2
	1	2½	78.00	24.25	0.465	4+	7.5	16.0	40.5	98.6
	1	6	81.75	25.75	0.495	1+	7.5	15.0	38.5	75.0
	1	9	82.00	26.25	0.500	0	8.4	15.9	41.2	70.2
	2		85.00	27.50	0.520	2+	8.1	15.7	38.6	82.3
	2	6	89.00	28.50	0.550	3+	8.0	16.9	44.2	116.0
	2	8	91.00	30.00	0.570	2+	7.6	16.3	39.1	106.9
	3		94.50	30.75	0.590	4+	7.5	17.6	44.8	138.3
	3	2½	94.50	33.25	0.615	4+	7.6	17.8	42.2	141.6
	3	6	96.50	32.75	0.620	4+	7.7	17.9	42.5	132.3
	3	9	98.75	34.75	0.650	3+	8.6	17.6	48.1	120.2
	4		99.75	35.50	0.660	4+	8.1	18.4	47.7	150.9
	4	3	101.25	37.25	0.680	4+	8.0	18.3	44.8	142.9
	4	5	104.00	38.50	0.700	4+	8.6	18.8	50.6	149.2
	4	9	106.00	40.25	0.725	4+	7.9	18.5	47.0	162.7
	5		107.00	39.75	0.725	4+	7.8	18.4	48.9	153.7
	5	3	108.25	43.50	0.760	4+	8.5	19.6	51.2	160.1
	5	6	110.00	44.00	0.775	4+	8.0	18.9	45.7	161.2
32		1	54.00	8.50	0.230	2+	5.7	10.9	16.0	30.4
		2	58.50	11.75	0.280	3+	6.3	12.8	14.6	46.1
		3½	62.50	14.00	0.315	3+	6.8	12.9	23.8	43.2
		6	67.25	18.00	0.370	2+	7.0	15.3	30.3	65.2
	1	3	80.00	.....	.....	3+	7.8	16.1	39.8	87.8
	1	7	82.50	27.00	0.550	3+	7.7	17.0	31.9	112.7
	1	10	84.00	28.00	0.540	4+	7.6	16.9	38.3	114.6
	2	1	91.00	29.50	0.565	4+	7.8	16.9	43.4	113.0
	2	3	92.00	30.00	0.575	4+	7.8	16.8	44.5	111.0
	2	6	93.00	31.50	0.590	4+	8.3	17.4	47.3	115.1
	2	10	95.00	33.50	0.620	4+	8.0	17.6	46.1	119.4
	3	1	98.50	33.12	0.635	4+	8.4	17.4	45.8	111.4
	3	4	99.00	34.00	0.640	4+	8.5	18.1	50.8	136.8
	3	8	100.50	35.75	0.660	4+	8.4	18.4	51.8	130.0
	3	10	102.75	36.00	0.675	4+	8.7	18.9	50.2	134.7
	4		104.50	37.75	0.695	4+	8.5	19.2	56.5	159.0
	4	4	106.75	37.00	0.700	4+	8.8	19.0	57.2	151.6
	4	8	109.75	40.00	0.740	4+	8.8	18.9	55.2	139.9
	4	10	110.50	41.00	0.750	4+	8.8	18.8	55.0	164.3
	5	1	112.50	42.75	0.775	4+	9.0	19.5	53.7	158.5
	5	4	115.50	45.00	0.810	4+	9.2	19.3	55.6	146.5
	5	7	116.75	46.00	0.825	4+	9.0	19.1	53.9	157.0
	6		118.50	47.25	0.840	4+	8.5	18.8	50.9	162.7
33		1	53.75	10.00	0.245	2+	5.5	11.4	19.0	31.6
		2	58.00	11.75	0.280	2+	6.4	12.5	23.9	34.6
		7	69.50	20.50	0.400	2+	7.8	15.8	40.2	61.3
		11	71.00	23.00	0.425	1+	7.3	15.6	34.3	69.6
	1	5	81.50	27.25	0.515	2+	7.7	16.7	40.4	98.4
	1	7	82.50	29.00	0.520	1+	8.1	17.0	44.4	74.4
	1	10	86.00	28.75	0.540	1+	7.7	16.9	42.4	84.2
	2	1	87.50	30.00	0.560	4+	7.4	17.7	43.1	123.1
	2	4	89.75	30.50	0.570	2+	7.8	17.4	40.3	101.0
	2	7	92.75	32.00	0.605	3+	7.8	18.2	44.0	107.2
	2	10	94.25	33.25	0.615	2+	7.6	17.7	41.2	119.5
	3		95.50	35.00	0.640	3+	8.2	18.3	43.3	120.0
34		1½	53.25	8.50	0.225	0	5.7	10.2	16.3	16.6
		2	55.25	11.00	0.260	1+	6.0	11.8	20.6	35.7
		3	59.50	13.00	0.295	0	6.3	12.2	21.1	31.2
		6	66.00	17.00	0.355	0	6.7	14.6	27.6	44.5
		9	71.00	19.50	0.400	0	7.3	14.4	29.7	46.6
	1		73.00	20.50	0.415	0	7.6	14.5	31.1	45.8
	1	3	78.50	22.00	0.450	2+	7.5	15.8	32.7	73.5
	1	7	82.00	24.75	0.485	2+	7.9	16.3	41.1	78.3
	1	9	84.50	25.00	0.500	1+	8.2	16.0	39.1	75.0
	2		85.25	27.25	0.520	2+	7.9	17.1	37.5	87.7
	2	3½	89.50	29.50	0.560	3+	7.1	17.5	36.1	128.0
	2	6	91.50	29.50	0.570	4+	7.5	17.8	41.6	129.5
	2	9	93.00	30.25	0.580	3+	8.0	17.5	45.0	116.7
	3	3	98.50	34.00	0.640	3+	8.9	18.5	50.5	129.8
	3	6	99.00	34.75	0.650	4+	8.6	18.5	45.7	131.6
	3	9	101.50	35.25	0.670	3+	8.3	19.0	44.1	143.9
	4		104.00	37.00	0.690	4+	8.7	19.1	52.9	165.6
	4	3	106.50	38.00	0.710	4+	9.2	19.5	54.5	157.7
	4	6	109.25	39.50	0.735	3+	8.0	18.5	43.2	141.8
	4	10	109.50	39.75	0.740	3+	8.7	18.8	46.6	143.6
	5		112.25	41.75	0.760	3+	8.8	19.6	53.1	152.0
	5	3	113.50	43.25	0.785	3+	9.1	19.6	58.0	156.1
	5	6	115.00	45.00	0.810	3+	8.8	19.6	50.1	152.5

TABLE 5.—*Individual Measurements on Boys*—Continued*

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
35		1	51.50	8.50	0.220	0	5.6	9.8	16.7	17.5
		2	56.00	12.00	0.270	0	6.3	12.1	19.5	33.1
		3	57.00	13.00	0.285	0	6.3	11.4	19.7	29.2
		6	65.00	17.25	0.355	1+	7.1	13.8	26.2	48.2
		10	68.75	21.75	0.400	1+	7.5	14.8	29.3	62.1
	1		75.25	23.75	0.450	1+	8.1	15.6	36.7	68.7
	1	3½	78.50	26.00	0.480	0	8.7	15.3	38.6	59.1
	1	6	80.00	28.00	0.500	2+	8.4	16.4	40.4	83.8
	1	9	83.50	29.75	0.535	2+	7.9	16.7	35.3	105.3
	2		86.75	31.75	0.565	4+	8.1	16.4	43.2	114.7
	2	3	87.75	33.00	0.580	4+	8.3	17.0	47.0	115.1
	2	6	91.00	33.75	0.600	3+	8.4	17.3	46.0	116.2
	2	9	91.50	35.50	0.620	3+	8.2	16.8	40.1	107.5
	3		93.25	36.50	0.635	3+	8.7	17.9	46.6	116.8
	3	2	95.00	36.50	0.640	4+	8.5	17.7	46.2	123.0
	3	6	96.50	37.75	0.660	4+	8.6	17.4	45.1	122.4
	4		101.25	39.25	0.690	3+	9.0	17.5	45.7	114.4
	4	3	102.75	40.00	0.710	4+	8.6	17.4	45.6	136.0
	4	6	106.00	41.50	0.730	4+	9.2	17.5	53.0	125.6
	4	9	106.75	42.00	0.740	4+	8.0	17.7	43.4	139.6
	5		108.00	42.50	0.750	4+	7.9	17.2	45.7	130.7
36		2½	55.75	11.50	0.265	2+	5.9	12.4	17.6	37.3
		6	64.50	16.00	0.340	1+	6.5	13.4	22.2	40.1
		9½	70.50	20.00	0.400	2+	6.8	15.7	27.5	68.7
	1		74.50	21.75	0.430	2+	7.4	16.7	31.6	77.0
	1	3½	76.50	24.75	0.465	2+	7.6	17.4	31.9	91.5
	1	9	85.00	25.50	0.505	4+	7.4	17.7	36.7	128.0
	2		86.00	26.50	0.520	2+	7.4	16.8	35.3	91.1
	2	6	89.75	28.50	0.550	3+	7.7	16.7	38.1	101.2
	2	9	91.50	28.50	0.560	4+	6.9	17.4	33.1	127.5
	3	4	95.00	31.00	0.600	4+	7.7	17.8	45.0	131.9
	3	6	96.50	31.50	0.610	4+	7.8	17.5	45.0	146.0
	3	10½	99.00	31.75	0.625	4+	7.6	17.8	42.2	133.2
	4	2	101.25	34.25	0.660	4+	8.1	18.6	49.5	152.2
	4	4½	102.50	35.25	0.675	4+	8.2	19.0	49.7	167.0
	4	6½	103.00	35.50	0.675	4+	6.7	16.8	40.8	163.6
	4	10	105.25	36.50	0.690	4+	7.7	18.1	46.3	157.2
	5	3	106.75	38.50	0.710	4+	7.8	18.8	41.7	151.6
	5	6	109.25	39.25	0.730	4+	7.5	18.8	41.9	161.7
37		1½	55.50	8.75	0.235	2+	5.4	10.1	17.8	22.1
		2½	59.50	12.75	0.290	1+	6.4	12.3	23.6	31.7
		3½	63.50	15.25	0.330	1+	6.9	12.3	24.6	32.3
		6½	70.00	19.50	0.390	1+	7.3	14.9	32.4	52.5
		9½	73.50	22.75	0.435	1+	7.6	15.8	37.9	64.1
	1		78.50	24.25	0.470	1+	8.0	16.7	40.0	70.0
	1	3½	81.50	25.50	0.490	2+	8.0	17.0	44.0	81.3
	1	6	84.00	25.50	0.500	4+	7.4	16.7	39.0	108.1
	1	10	86.50	27.25	0.530	2+	7.4	16.3	41.3	99.1
	2	1	88.50	28.75	0.550	4+	8.0	17.8	43.7	120.4
	2	4	90.50	28.50	0.560	4+	7.7	17.6	44.8	132.5
	2	8	91.50	30.25	0.580	3+	8.3	17.3	46.6	120.4
	2	9½	94.00	30.50	0.590	2+	8.1	17.1	49.1	115.3
	3	1	95.00	30.75	0.595	4+	8.1	18.6	50.3	158.9
	3	6½	99.00	32.75	0.635	4+	7.9	18.6	50.4	146.3
	3	9½	101.50	33.25	0.650	4+	8.5	18.8	53.7	155.3
	4	2	104.50	36.75	0.690	4+	8.3	18.3	52.8	153.4
	4	4	105.50	35.50	0.685	4+	7.8	17.8	50.1	159.8
	4	9	107.25	39.00	0.720	4+	8.7	18.3	56.6	146.6
	5		108.75	38.75	0.725	4+	8.4	18.4	56.4	150.5
38		2	54.00	9.50	0.240	3+	4.8	10.3	15.8	28.9
		3	58.50	11.00	0.270	4+	6.0	11.9	23.0	42.3
		5	63.50	14.75	0.325	3+	6.6	13.4	24.4	50.3
		9	69.50	20.00	0.395	3+	7.4	15.1	34.3	65.1
		11	73.00	21.75	0.420	1+	7.7	15.0	36.8	53.0
	1	2	76.00	22.75	0.445	2+	7.5	15.3	38.8	66.5
	1	5	80.00	26.00	0.490	3+	7.2	16.0	39.1	83.5
	1	10	81.50	26.50	0.500	3+	7.5	15.8	39.8	84.5
	1	11	86.50	28.75	0.540	1+	7.6	15.5	38.2	73.9
	2	2	87.50	30.25	0.560	3+	7.7	16.8	40.5	106.4
	2	5	90.00	32.00	0.580	4+	7.3	16.1	39.0	114.5
	2	9	91.25	33.00	0.590	4+	7.6	16.7	43.2	107.8
	3	1	95.75	34.75	0.630	4+	7.8	17.0	43.5	108.2
	3	5	99.75	35.50	0.660	4+	7.8	17.1	40.4	124.7
	3	8	101.00	36.50	0.670	4+	7.6	16.9	46.1	131.1
	3	11	104.25	38.75	0.700	4+	7.8	17.7	45.0	140.4
	4	3	106.50	36.50	0.700	3+	7.9	17.7	42.9	126.6
	4	5	107.00	40.25	0.730	3+	8.3	17.7	47.2	129.7
	4	9	109.75	42.00	0.755	4+	8.2	17.6	46.7	142.7
	4	11	111.00	45.50	0.790	4+	8.7	18.1	50.7	147.6
	5	2	113.00	47.00	0.810	4+	8.9	18.1	48.4	143.6

TABLE 6.—*Individual Measurements on Girls* *

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
39		1	52.75	9.50	0.235	2+	5.4	11.0	15.7	28.8
		2	55.50	11.50	0.265	2+	6.0	12.1	15.7	35.1
		3	58.50	14.25	0.300	1+	5.9	13.0	17.4	43.6
		6	61.50	19.50	0.360	0	6.5	13.9	24.0	46.1
		9	66.50	22.25	0.400	1+	6.9	14.8	25.4	57.0
	1		72.00	25.00	0.445	2+	7.4	15.5	28.6	72.4
	1	3	75.50	26.25	0.475	0	6.9	16.1	28.6	73.3
	1	8	80.00	28.75	0.510	2+	7.1	16.0	30.0	81.8
	1	10	82.50	30.50	0.535	0	7.4	16.5	30.3	79.5
	2		83.50	30.25	0.540	3+	7.2	16.5	34.4	98.0
	2	3½	87.50	31.25	0.560	3+	7.3	16.9	37.9	129.3
	2	6	88.00	32.50	0.580	3+	7.9	18.3	42.0	128.5
	2	10	90.25	33.50	0.600	3+	7.2	18.0	36.9	132.0
	3		92.50	34.00	0.610	3+	7.8	18.4	40.4	134.5
	3	3	94.75	34.50	0.620	3+	8.1	18.7	44.5	144.0
	3	6	95.50	35.50	0.640	3+	8.0	18.5	42.9	129.9
	3	9	97.00	37.25	0.660	3+	8.2	19.1	45.9	147.6
	4	1	100.25	38.50	0.680	4+	7.9	18.8	46.5	153.6
40		1	52.75	8.25	0.220	2+	5.1	10.6	15.5	26.9
		2	57.50	10.00	0.260	2+	4.7	10.3	14.1	29.7
		4	60.50	11.75	0.285	3+	5.2	12.1	16.7	44.7
		6	65.00	14.50	0.330	3+	6.0	13.6	23.5	55.5
		9	68.00	17.50	0.370	4+	6.7	14.7	26.5	65.6
	1		72.25	18.75	0.395	3+	6.7	14.0	26.2	55.9
	1	4	78.25	21.25	0.440	3+	7.0	14.6	30.9	61.9
	1	6	80.75	22.50	0.460	3+	7.2	14.7	31.8	66.8
	1	9	85.00	24.00	0.490	4+	7.2	15.7	33.0	92.8
	2		86.75	24.75	0.510	4+	7.5	16.1	36.6	90.9
	2	4	90.50	27.00	0.540	4+	7.6	16.6	39.5	109.5
	2	6	92.75	28.50	0.580	3+	7.7	16.4	38.2	98.9
	2	9	95.25	30.50	0.600	3+	8.0	16.8	42.2	112.1
	3		97.50	31.50	0.620	3+	7.4	17.0	42.1	107.5
	3	3½	99.00	32.75	0.635	4+	8.0	17.3	46.4	130.0
	3	7	101.50	34.00	0.660	4+	8.0	17.8	44.9	139.8
41		1	52.50	9.00	0.230	1+	5.6	10.9	19.0	25.7
		2	57.25	11.25	0.270	3+	6.3	12.6	20.5	41.2
		3	59.25	12.50	0.290	3+	6.1	12.4	25.2	41.1
		6	67.00	16.50	0.355	1+	7.0	13.8	26.5	44.5
		9	71.25	18.25	0.390	2+	6.7	14.4	27.7	60.6
	1		76.00	19.75	0.420	1+	7.0	15.1	29.2	66.8
42		1	52.50	9.00	0.230	1+	5.6	10.6	15.2	19.8
		2	55.50	11.00	0.265	1+	5.6	11.3	16.1	27.2
		3½	60.50	13.75	0.310	2+	6.0	12.0	17.4	31.6
		6	66.00	16.25	0.350	2+	6.3	12.4	20.5	41.6
		9	70.00	17.50	0.375	2+	7.2	14.2	26.5	48.8
	1		75.00	20.50	0.420	1+	7.6	14.5	29.2	46.1
	1	6	77.00	22.75	0.450	1+	7.6	14.4	30.9	53.0
	1	9	81.50	23.75	0.480	2+	7.6	15.0	28.2	59.0
	2		83.50	25.00	0.500	2+	7.6	15.4	32.8	77.0
	2	3	86.50	25.25	0.515	1+	7.9	15.0	35.5	67.5
	2	6	88.00	27.50	0.540	3+	7.5	16.2	37.6	104.6
	2	9	90.75	29.25	0.560	2+	7.9	16.5	37.9	83.6
	3		92.00	30.25	0.580	3+	7.9	16.5	36.9	92.2
	3	3	94.50	30.50	0.590	2+	8.1	16.7	39.5	99.6
	3	5	95.75	30.25	0.600	1+	8.1	16.3	41.0	89.6
	3	8	97.25	32.25	0.620	4+	8.3	16.7	42.6	107.3
	3	11	99.00	32.50	0.630	4+	8.0	16.5	39.1	112.1
	4	2	100.75	33.25	0.645	4+	7.9	16.4	41.0	120.4
43		½	53.25	7.50	0.215	1+	5.0	10.4	14.6	24.9
		1½	56.75	9.50	0.250	1+	5.7	11.3	17.8	26.5
		2½	59.50	12.00	0.285	3+	5.2	12.0	19.6	39.0
		5½	68.00	17.25	0.365	1+	6.5	14.3	21.3	45.5
		8½	72.50	19.00	0.400	0	7.1	14.5	30.3	47.4
	1		75.75	21.75	0.435	1+	6.6	15.6	25.8	73.7
	1	2½	80.50	23.50	0.470	0	7.6	16.3	32.3	83.3
	1	6	82.00	24.50	0.485	3+	7.2	16.6	34.8	99.6
	1	8½	85.00	25.00	0.500	2+	7.8	16.7	37.8	85.0
	2		87.00	26.75	0.525	3+	7.6	17.3	40.1	108.9
	2	2	89.50	28.00	0.550	1+	7.8	16.5	39.6	73.8
	2	8½	98.00	29.50	0.600	4+	7.6	17.3	43.1	116.5
	2	11½	98.25	32.25	0.625	3+	7.6	17.1	43.1	121.4
	3	3	100.25	34.50	0.655	4+	8.2	17.6	45.4	123.9
	4	1	106.50	39.25	0.720	4+	8.4	18.0	49.1	133.7
44		1½	53.75	9.75	0.240	2+	5.2	11.3	20.4	28.2
		3	57.75	12.50	0.285	2+	5.4	12.1	22.5	37.2
		4	61.50	14.50	0.315	2+	5.9	13.1	25.0	....
		6	66.00	16.25	0.350	3+	6.3	14.7	30.4	65.0
		9	69.00	19.50	0.390	2+	6.7	14.8	30.9	60.3

* Ht. indicates height; Wt., weight; B.S.A., body surface area; Deg. of Insp., degree of inspiration (explained in text); T.D., total transverse diameter of heart; I.D., internal diameter of heart; C.S.A., cardiac surface area, and L.S.A., lung surface area.

TABLE 6.—*Individual Measurements on Girls*—Continued*

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
	1		73.00	21.25	0.420	3+	6.3	15.3	29.9	78.1
	1	4	78.00	23.50	0.460	3+	7.2	16.8	41.8	89.2
	1	10	82.00	26.50	0.500	1+	7.9	17.3	36.8	97.3
	2	1	84.50	26.75	0.515	3+	7.3	17.3	38.5	112.4
	2	5	88.50	27.00	0.535	2+	7.5	17.6	38.6	110.2
	2	10	91.00	28.25	0.560	1+	7.6	17.2	39.0	87.5
	3	1	92.50	30.00	0.580	3+	7.1	18.0	38.0	139.1
	3	4	94.75	30.00	0.585	4+	7.4	18.2	40.7	133.0
	3	6½	95.00	30.50	0.595	3+	8.0	17.9	44.6	125.3
	3	9	97.50	31.50	0.620	3+	8.0	17.8	39.8	123.1
	4	1	100.00	33.00	0.640	4+	7.4	17.8	39.6	132.4
45		1	49.50	6.50	0.190	2+	5.5	10.6	15.5	27.5
		2	53.25	9.25	0.235	0	6.0	11.3	17.4	28.4
		3	55.50	10.75	0.260	0	6.7	12.3	22.8	35.4
		6	61.00	14.00	0.310	1+	7.0	12.7	24.7	40.1
		9	63.75	15.25	0.330	1+	7.2	13.8	27.8	50.6
	1		69.50	16.50	0.365	0	7.8	14.2	30.1	50.6
	1	3	72.50	18.00	0.390	1+	7.9	14.8	31.7	55.5
	1	6	75.00	18.25	0.400	2+	8.0	15.5	33.6	70.9
	1	9	79.00	20.50	0.440	1+	8.4	16.0	36.2	72.5
	2		81.50	21.00	0.455	4+	8.1	15.8	40.4	96.2
	2	3	84.00	22.50	0.480	3+	8.2	15.8	41.4	93.5
	2	7	85.75	23.25	0.490	2+	8.4	15.8	39.2	93.8
	2	9	87.00	24.00	0.500	2+	8.5	15.7	38.0	81.2
	3		89.50	25.50	0.525	2+	8.5	16.3	37.7	94.9
	3	3	91.50	26.00	0.540	3+	8.2	17.0	42.3	123.5
	3	6	92.50	27.50	0.560	3+	8.6	16.9	39.5	107.2
	3	9	95.00	29.00	0.580	3+	8.6	16.9	39.5	109.4
46		1½	53.00	8.00	0.220	2+	5.7	11.4	18.8	33.4
		3	57.75	11.25	0.270	1+	6.3	12.2	22.6	33.1
		4	59.50	13.25	0.295	1+	6.2	12.6	22.2	38.7
		7	67.50	16.00	0.350	2+	7.0	14.4	28.5	59.4
		10	73.00	18.25	0.395	1+	7.2	14.7	29.3	60.9
	1	½	74.50	19.25	0.410	2+	7.4	15.8	33.3	83.9
	1	3½	77.50	20.00	0.430	1+	7.2	15.4	30.4	78.9
	1	7½	81.00	22.00	0.460	0	8.2	16.4	35.8	72.8
	1	10	81.50	22.00	0.460	1+	7.5	16.2	36.2	89.7
	2	1	87.00	23.00	0.490	3+	6.7	16.7	34.6	123.4
	2	3½	89.00	24.00	0.510	4+	7.4	17.0	38.2	120.0
	2	6½	92.50	26.00	0.540	3+	7.5	17.3	38.9	127.1
	2	9½	94.75	26.00	0.550	3+	7.8	17.8	40.3	126.3
	3		96.25	27.50	0.575	4+	8.1	17.7	40.6	119.8
	3	3½	98.50	27.75	0.585	3+	8.2	17.8	43.3	126.9
	3	6½	99.75	28.25	0.600	4+	8.1	18.0	48.6	141.2
	4		105.25	31.00	0.650	4+	7.8	17.0	42.5	133.7
47		1	55.75	9.00	0.240	2+	5.0	11.5	14.7	32.4
		2	60.25	11.00	0.280	2+	5.6	11.6	19.0	34.0
		3	62.50	12.00	0.295	2+	5.9	12.7	23.3	43.1
		6½	69.75	17.25	0.370	3+	6.3	14.5	26.1	63.9
		9½	74.50	21.25	0.425	1+	6.9	15.5	31.3	63.8
	1		77.50	23.50	0.460	2+	6.9	15.6	31.0	73.0
	1	3	80.50	24.50	0.480	2+	7.5	16.5	33.9	74.5
	1	6	85.00	25.50	0.510	2+	7.6	17.0	38.7	101.4
	1	9	86.00	27.00	0.520	2+	7.3	16.6	32.2	82.5
	2		88.50	28.00	0.540	2+	7.3	16.5	32.4	97.6
	2	2	91.50	28.00	0.560	2+	7.5	17.2	35.4	101.6
	2	6	93.50	29.50	0.580	2+	7.7	17.3	39.2	117.1
	2	9	95.50	31.50	0.600	4+	8.0	18.7	44.7	132.2
	3		97.75	32.75	0.625	4+	8.3	18.7	42.6	130.7
	3	3	99.25	33.00	0.640	3+	8.0	18.5	39.8	119.0
	3	6	101.50	34.75	0.660	4+	8.2	19.1	41.5	138.9
	3	9	104.00	35.50	0.680	4+	8.2	19.3	45.8	146.3
48		1	51.50	8.00	0.215	3+	5.1	10.9	18.8	30.1
		2	54.50	9.00	0.235	1+	5.5	11.0	17.8	24.4
		3	58.00	10.50	0.265	2+	6.2	12.8	23.5	41.8
		6	63.00	15.25	0.330	1+	7.0	14.2	28.7	49.1
		9	69.25	20.50	0.400	2+	7.1	14.5	29.6	59.4
	1		71.50	22.75	0.425	0	7.5	15.3	33.1	61.3
	1	3	76.50	26.00	0.475	0	7.9	15.6	39.0	61.1
	1	6	80.00	27.75	0.500	1+	8.2	16.6	42.4	78.0
	1	9	83.00	29.25	0.530	1+	7.7	16.8	40.5	95.3
	2		85.50	30.50	0.550	1+	7.8	16.8	40.2	86.4
	2	3	87.75	32.50	0.580	2+	7.7	17.0	40.9	102.7
	2	6	90.25	34.00	0.600	2+	8.1	17.4	45.5	105.0
	2	9	93.25	34.75	0.620	1+	8.7	17.0	47.5	87.8
	3		96.75	36.75	0.650	3+	7.7	18.0	46.0	133.7
	3	3	97.50	37.75	0.660	3+	8.2	18.3	48.7	138.7
	3	6	99.50	38.50	0.680	3+	8.8	19.0	55.0	146.1
	3	10	102.25	40.00	0.710	3+	8.9	18.8	54.3	136.7

TABLE 6.—*Individual Measurements on Girls*—Continued*

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
49		1	55.50	9.50	0.245	1+	5.0	10.3	15.6	24.5
		2	58.50	12.00	0.280	1+	5.8	11.6	21.7	30.8
		3	60.50	13.00	0.300	2+	5.5	12.1	21.4	42.7
		6	65.50	15.25	0.340	2+	6.3	13.2	30.2	52.6
		9	70.50	17.50	0.380	1+	6.9	14.8	33.0	56.5
	1		76.00	22.00	0.440	1+	7.1	15.5	34.9	74.3
	1	3	78.50	24.25	0.470	1+	7.4	15.6	39.7	71.4
	1	6	83.75	27.25	0.520	1+	7.7	16.2	43.6	66.4
	1	9	87.50	27.75	0.540	3+	7.1	17.5	39.3	126.9
	1	11	89.50	28.50	0.550	3+	7.5	17.7	42.1	128.0
	2	3	92.00	29.25	0.565	3+	7.5	17.3	41.6	106.0
	2	6	93.00	30.50	0.580	3+	7.0	17.6	39.0	132.2
	2	9	96.00	31.00	0.605	2+	7.7	17.3	41.9	96.7
	3		97.00	34.00	0.615	4+	7.2	17.6	44.0	136.4
	3	3	100.75	35.00	0.660	4+	7.6	17.8	47.4	154.2
	3	6	102.00	36.75	0.680	4+	7.6	18.8	46.3	158.1
	3	9	104.00	37.50	0.695	4+	8.0	18.2	49.9	160.0
	4		105.75	38.00	0.705	4+	7.6	18.1	47.2	151.5
	4	3	108.00	40.25	0.735	4+	7.8	18.3	49.0	145.4
	4	6	109.25	40.00	0.740	4+	8.1	18.5	48.5	157.1
50		1	52.00	8.00	0.220	3+	5.4	10.4	18.0	26.4
		2	56.25	9.50	0.250	3+	6.5	12.0	22.4	31.1
		3	59.25	11.25	0.280	3+	6.4	12.4	24.7	38.8
		6	64.00	16.75	0.345	2+	7.1	14.3	28.3	47.2
		9	70.00	20.25	0.400	3+	7.5	14.8	33.6	57.6
	1		75.50	23.25	0.450	4+	7.8	15.8	33.7	73.4
	1	3	79.50	23.75	0.470	4+	7.9	15.6	35.7	76.0
	1	6	82.50	25.25	0.495	4+	7.7	16.0	38.9	86.1
	1	9	85.50	27.50	0.525	4+	8.0	16.3	41.9	106.5
	2		89.50	28.75	0.550	4+	8.1	16.6	43.0	115.7
	2	3	91.50	28.25	0.560	4+	8.0	16.5	42.5	116.9
	2	6	94.50	31.50	0.600	4+	8.3	16.8	42.7	104.2
	2	9	96.00	32.25	0.615	4+	8.3	17.3	44.3	107.4
	3	½	99.00	34.25	0.650	4+	8.4	17.6	50.5	144.2
	3	3	101.00	35.75	0.670	4+	8.0	17.1	45.6	115.4
	3	6½	103.50	36.75	0.685	4+	8.4	16.9	49.2	131.4
	3	9	105.50	38.25	0.710	4+	8.2	17.3	44.6	132.8
	4		107.00	39.75	0.725	4+	8.6	17.0	51.9	132.6
	4	3	107.00	41.25	0.730	4+	8.3	17.2	50.9	147.8
	4	6	109.25	43.25	0.775	4+	8.7	17.6	54.2	146.6
	4	10	114.25	44.50	0.800	4+	8.4	17.3	46.5	139.7
51		2	58.00	10.50	0.265	2+	5.9	12.6	20.3	34.5
		4½	63.00	14.00	0.320	0	6.1	14.1	21.7	43.7
		5	63.50	14.50	0.325	1+	6.3	13.9	21.3	44.7
		8	69.75	18.75	0.385	1+	7.0	15.8	33.1	65.7
		10½	74.00	20.75	0.420	0	7.1	15.6	29.8	61.6
	1	2	77.00	22.75	0.450	2+	7.5	17.0	33.7	88.9
	1	5	81.00	24.00	0.480	2+	7.5	17.2	37.7	95.2
	1	8	83.00	25.00	0.495	1+	7.2	16.5	28.9	87.8
	1	11	88.00	26.75	0.530	2+	7.2	16.5	32.4	89.8
	2	3½	90.50	28.75	0.560	3+	7.3	17.8	35.7	131.5
	2	9	94.50	30.50	0.590	4+	7.9	16.4	42.6	115.1
	3		96.50	31.50	0.610	3+	7.4	17.5	34.7	114.4
	3	2	99.00	31.33	0.620	3+	7.3	17.8	38.1	127.2
	3	5	99.75	33.25	0.640	3+	7.8	18.0	40.7	120.9
	3	9	103.00	35.00	0.675	3+	7.5	17.9	40.6	139.6
	4		105.25	35.25	0.690	3+	8.0	17.4	45.7	138.7
52		1	58.00	10.25	0.260	1+	6.4	12.2	20.9	33.1
		3	63.75	14.75	0.330	2+	6.7	13.2	26.2	42.9
		6	70.50	17.50	0.380	0	7.3	15.5	27.0	61.3
		9	74.50	20.50	0.420	1+	7.9	17.2	33.0	76.0
	1		78.00	22.50	0.450	1+	7.1	15.7	29.7	79.3
	1	3	80.50	23.75	0.470	0	7.4	16.4	32.1	85.2
	1	6	84.50	25.50	0.500	1+	7.0	17.4	32.5	111.1
	1	10	86.50	26.50	0.520	1+	7.7	16.8	35.6	95.3
	2		91.25	28.00	0.560	1+	7.8	18.1	38.4	111.7
	2	4	92.75	30.00	0.580	1+	7.5	17.9	38.1	109.2
	2	7	96.00	31.75	0.610	3+	8.0	19.1	39.2	137.8
	2	9	97.00	32.50	0.620	3+	8.2	19.2	49.0	150.8
	3		100.50	33.75	0.650	3+	8.4	18.8	43.6	129.5
	3	4	103.00	35.25	0.680	3+	8.5	19.8	48.5	158.8
	3	6	105.00	35.75	0.685	3+	8.5	19.0	52.3	148.4
	3	11	108.00	38.25	0.720	3+	7.6	18.4	46.0	154.5
	4	3	109.25	41.25	0.750	4+	8.3	18.8	47.3	157.2
53		1	50.50	7.75	0.210	0	5.2	10.5	13.2	20.6
		2	53.50	9.50	0.240	1+	5.9	12.0	18.0	32.9
		3	55.00	12.00	0.270	0	6.0	11.4	16.2	24.2
		5	62.00	17.00	0.340	0	6.6	14.0	21.6	40.7
		9	66.50	20.00	0.380	1+	6.2	13.8	18.4	50.6
	1		69.25	22.00	0.410	0	7.8	15.4	32.3	55.2
	1	3	73.50	22.00	0.430	2+	7.0	16.4	31.1	86.2
	1	6	78.50	24.00	0.465	2+	7.1	16.1	30.0	86.6

TABLE 6.—*Individual Measurements on Girls*—Continued*

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
54	1		76.25	24.50	0.460	0	7.5	14.5	25.0	49.8
	1	5	80.25	26.00	0.490	2+	6.9	15.5	28.4	85.0
	1	8	82.50	27.50	0.510	2+	7.7	17.0	32.6	102.0
	1	11	87.00	27.50	0.530	1+	7.7	15.5	29.7	76.1
	2	2	89.50	28.75	0.555	2+	7.8	16.0	35.2	82.9
	2	5	91.75	29.50	0.570	3+	7.9	17.3	36.3	120.8
	2	8	92.50	30.25	0.580	4+	7.8	17.3	37.5	126.1
	2	11	95.50	31.00	0.600	4+	7.7	15.9	39.3	128.3
	3	2½	97.75	33.00	0.630	3+	8.0	17.1	41.4	119.6
	3	5	99.00	34.75	0.650	4+	8.4	17.0	42.1	108.7
	3	8	101.50	35.25	0.670	4+	8.2	17.6	45.1	132.2
	4		104.50	36.00	0.685	4+	8.1	16.7	44.9	123.3
	4	2	106.00	37.25	0.700	4+	7.5	16.9	41.4	130.6
	4	5	107.25	37.75	0.710	4+	7.6	16.8	40.1	134.5
	4	8	109.00	40.00	0.740	4+	7.6	16.8	40.9	130.7
55		1	52.25	9.75	0.240	1+	5.9	10.9	16.8	19.5
		1½	55.50	11.50	0.265	2+	6.0	10.9	16.9	24.0
		3	60.75	14.25	0.310	1+	6.5	12.5	22.4	31.9
		6	64.00	17.00	0.350	1+	6.5	13.7	23.3	46.0
		10	68.50	20.25	0.395	2+	6.8	14.5	30.3	61.7
	1		71.00	21.50	0.415	2+	7.6	14.5	31.8	54.1
	1	3	73.50	23.00	0.435	2+	7.5	15.6	34.0	71.4
	1	6	75.50	22.50	0.440	2+	7.9	15.3	32.0	67.3
	1	9	78.50	25.00	0.475	1+	8.2	15.2	37.8	60.5
	2		81.50	27.00	0.505	2+	8.2	16.1	42.0	79.0
	2	3	83.50	28.50	0.520	1+	8.5	15.7	41.2	64.1
56		1	54.50	8.50	0.230	2+	5.1	9.8	15.0	28.5
		2	58.50	9.50	0.255	0	5.2	10.4	15.0	26.7
		6	63.00	15.00	0.330	0	5.9	12.6	19.9	42.8
		9	71.00	19.50	0.395	0	6.7	13.2	25.9	47.4
	1		73.50	21.00	0.420	0	7.0	13.3	29.6	52.0
	1	4	80.50	20.25	0.440	1+	7.5	14.5	34.0	61.2
	1	6	81.00	24.50	0.480	0	7.4	15.1	37.2	73.4
	1	9	83.00	25.25	0.500	1+	7.7	14.8	36.2	59.4
	2		83.50	28.75	0.525	2+	7.3	15.3	36.4	86.6
	2	3	89.25	28.25	0.550	1+	7.7	15.4	39.6	83.3
	2	5	91.25	29.25	0.565	3+	7.5	15.8	40.1	96.7
	2	9	93.50	31.50	0.600	0	8.2	15.8	41.8	85.5
	3	3½	99.00	32.75	0.630	3+	8.3	17.3	45.6	134.8
	3	9	102.25	36.50	0.680	4+	7.7	17.5	46.4	142.0
	4		103.50	36.50	0.685	3+	7.6	16.8	44.5	121.3
	4	3	105.50	37.50	0.700	4+	7.6	16.6	42.1	124.7
	4	6	107.25	37.75	0.710	4+	7.4	16.8	42.7	135.2
	5	1	112.25	43.75	0.780	3+	8.0	17.2	49.4	143.4
	5	5	114.25	42.75	0.785	4+	7.9	17.4	44.7	146.2
	5	8	117.50	43.75	0.810	4+	8.0	17.8	48.9	161.7
	5	11	120.00	45.75	0.840	4+	7.8	17.7	46.9	161.0
57		1	54.75	8.75	0.235	3+	5.2	10.6	13.9	30.8
		2	59.50	10.25	0.265	2+	5.4	11.2	15.7	29.0
		3½	64.00	12.00	0.300	2+	5.5	12.3	18.1	41.3
		6	68.50	15.75	0.355	1+	6.1	13.3	17.3	44.0
		9½	74.00	18.75	0.400	1+	6.2	13.1	19.7	48.9
		11½	78.00	20.25	0.430	1+	6.5	14.5	23.6	64.3
	1	2½	81.00	23.25	0.470	1+	6.6	15.1	23.9	67.1
	1	6	85.00	24.25	0.500	3+	6.7	15.8	29.7	87.4
	1	9	88.00	24.50	0.510	3+	6.8	16.6	29.8	109.1
	2	2	92.50	26.75	0.550	2+	7.3	16.0	33.4	86.8
	2	4½	94.00	27.50	0.560	1+	7.3	15.1	32.3	66.9
	2	8	96.50	28.75	0.585	3+	7.4	15.8	37.0	97.0
	2	9½	97.00	29.75	0.600	4+	7.5	16.1	39.2	108.6
	3	1	99.75	31.00	0.620	4+	7.5	16.8	38.7	123.2
	3	3	101.50	31.50	0.640	3+	7.6	16.6	38.5	106.6
	3	6	104.00	32.00	0.650	4+	7.6	16.6	40.9	114.4
	3	9	106.00	34.75	0.680	4+	7.7	16.8	41.7	110.4
58		2	54.50	9.75	0.245	1+	5.4	10.4	14.6	22.2
		4	59.75	13.75	0.300	1+	5.5	11.4	15.1	27.5
		7	63.75	16.75	0.345	0	6.6	12.4	19.1	29.5
		10	68.50	18.75	0.380	0	7.0	13.9	19.4	36.7
	1	1	73.00	21.25	0.420	0	7.2	14.3	24.5	40.5
	1	4	76.50	22.50	0.450	0	7.1	14.6	26.9	49.1
	1	7	78.50	24.00	0.465	0	7.4	15.4	29.2	68.8
	1	10	81.25	24.75	0.485	2+	7.0	15.9	29.1	80.0
	2	1	83.00	26.75	0.510	2+	7.2	16.0	30.4	84.9
	2	4	85.75	27.25	0.520	2+	7.9	16.1	33.0	79.5
	2	7	88.50	28.75	0.550	3+	8.0	16.5	38.1	88.3
59		1	56.50	7.75	0.230	4+	5.1	9.9	15.4	28.7
		2½	61.50	11.75	0.290	2+	6.8	12.5	24.0	35.2
		3	64.25	14.00	0.320	3+	6.1	12.8	22.8	45.1
		6	71.75	18.75	0.390	3+	7.3	14.5	27.0	59.0
		9	77.00	21.50	0.440	2+	7.6	14.7	29.6	62.3

TABLE 6.—*Individual Measurements on Girls*—Continued*

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
60		1	52.00	7.50	0.210	1+	4.8	10.2	17.1	26.6
		2	54.50	9.25	0.240	0	5.7	11.7	15.8	32.9
		3	57.00	10.25	0.260	0	5.8	11.8	19.0	37.1
		9½	67.75	17.50	0.365	0	7.3	15.4	27.1	55.7
	1	1	71.00	18.25	0.385	1+	7.5	16.2	35.9	67.4
	1	4	75.00	20.75	0.420	0	7.3	15.9	31.7	57.5
	1	9½	79.00	21.00	0.440	2+	7.6	16.7	32.0	85.1
	2	1	82.00	21.75	0.460	1+	7.8	16.2	36.2	76.3
	2	3	82.00	21.75	0.460	4+	6.9	16.7	34.9	120.0
	2	7	86.00	24.00	0.500	3+	7.1	16.7	37.9	119.6
	2	9½	87.75	25.50	0.520	2+	7.3	17.6	35.5	119.8
	3		89.75	25.25	0.520	4+	7.4	17.3	39.5	123.2
	3	6½	93.00	27.00	0.555	3+	7.7	17.6	43.6	123.2
	3	9½	96.25	27.75	0.580	3+	7.7	17.9	41.4	133.6
	4		96.25	28.00	0.580	3+	7.9	17.9	44.6	135.8
	4	3	97.50	28.50	0.590	4+	7.6	17.7	43.3	139.7
	4	6	100.25	29.50	0.610	4+	7.6	17.8	43.6	133.7
	4	10	103.00	31.00	0.640	3+	7.4	17.9	44.8	141.8
	5	1	104.00	31.75	0.650	4+	7.1	16.8	39.1	127.0
	5	3½	105.50	31.75	0.660	4+	7.8	17.6	43.2	134.5
	5	6½	106.50	33.00	0.675	4+	7.7	17.7	41.6	136.6
61		1	53.00	8.75	0.230	1+	6.1	11.5	18.6	24.0
		2	57.00	10.75	0.265	0	7.5	12.5	23.5	22.7
		2½	58.00	13.00	0.290	0	7.7	12.3	22.5	22.4
		3	61.00	14.25	0.310	0	7.8	14.1	27.4	32.4
		7	70.50	21.00	0.410	0	8.3	16.0	37.9	55.2
		9	75.00	23.50	0.450	1+	8.3	16.5	37.8	72.0
	1	½	76.50	25.50	0.470	0	8.3	16.8	38.5	63.9
	1	3	80.00	27.75	0.500	0	7.6	16.3	37.1	77.2
	1	6	83.75	28.00	0.520	1+	7.9	17.0	35.2	85.7
	1	9	85.00	29.50	0.540	0	8.3	16.2	33.5	60.5
	2		88.25	30.00	0.560	3+	8.0	18.2	43.4	126.4
	2	3	90.50	30.25	0.570	3+	7.8	18.3	45.3	128.1
	2	7	93.75	33.25	0.610	3+	7.8	18.4	38.8	134.4
	2	11	96.00	34.50	0.630	3+	7.9	18.7	42.1	138.7
	3		97.50	36.00	0.650	2+	8.3	19.1	42.4	134.2
	3	3	99.00	36.25	0.660	4+	7.9	18.9	47.5	153.5
	3	6	101.50	37.75	0.680	3+	8.4	18.9	49.6	143.8
	3	9	104.00	39.00	0.700	3+	7.6	18.6	45.7	151.7
	4		105.50	40.75	0.720	3+	8.3	18.9	48.2	151.5
	4	3	108.25	43.25	0.760	4+	8.1	18.0	50.2	149.6
	4	9	110.00	43.50	0.770	4+	8.1	18.7	49.7	166.6
	5		113.00	45.50	0.800	4+	7.9	19.0	44.2	154.8
62		1	53.00	7.75	0.220	3+	4.9	10.4	15.6	32.2
		2	55.50	9.75	0.250	3+	5.1	11.1	16.5	37.6
		3	59.75	12.00	0.285	3+	5.9	12.1	19.0	40.5
		6	66.50	15.75	0.345	2+	6.6	13.4	26.4	44.0
		10	73.25	20.00	0.410	2+	7.5	15.1	33.8	64.2
	1		75.50	21.00	0.430	2+	7.5	15.8	35.3	70.6
	1	3	80.25	24.00	0.475	3+	7.5	15.6	34.0	76.2
	1	6	84.50	27.25	0.520	3+	7.8	16.8	39.7	87.7
	2		91.75	29.00	0.565	3+	8.4	17.0	43.8	93.4
63		1	48.25	8.75	0.215	3+	5.8	9.7	17.4	18.6
		2	54.00	11.00	0.255	3+	6.5	10.6	19.7	21.4
		4	57.75	13.25	0.290	1+	7.2	12.5	24.6	29.8
		7	66.00	17.00	0.355	1+	8.1	13.1	32.4	32.8
	1		72.00	22.25	0.425	1+	9.1	14.9	40.3	45.6
	1	2½	75.50	24.50	0.460	0	9.0	15.2	39.9	48.8
	1	6	77.75	25.25	0.475	1+	9.1	15.5	42.8	52.3
	1	8	80.75	26.50	0.500	1+	9.0	15.8	45.2	60.3
	1	10	84.50	27.00	0.520	1+	8.9	16.4	45.8	68.8
	2	1	87.50	29.00	0.550	2+	9.2	17.4	51.5	96.5
	2	4	88.50	30.50	0.560	4+	8.7	17.7	45.4	120.2
	2	7	92.00	31.25	0.585	4+	8.7	17.5	46.9	117.3
	2	10	93.50	32.50	0.605	4+	8.7	17.8	48.8	124.7
	3	1	94.50	33.00	0.615	4+	8.9	17.9	47.2	132.2
	3	5	97.00	35.00	0.640	3+	9.0	17.9	45.8	108.5
	3	7	98.50	35.00	0.650	4+	9.0	18.1	49.1	135.3
	3	10	99.50	35.00	0.655	4+	9.0	18.6	51.1	153.9
	4	2	102.25	36.25	0.680	4+	9.0	18.2	49.0	138.9
	4	4½	102.75	36.25	0.680	4+	9.0	18.7	48.6	152.4
	4	7	104.00	37.25	0.695	4+	9.2	18.6	49.2	145.1
	4	10	105.50	38.00	0.700	4+	9.0	18.2	48.0	145.0
	5	1	107.50	38.50	0.720	4+	8.8	18.2	54.6	150.7
	5	4	108.00	41.25	0.740	4+	9.1	18.2	53.5	150.1

TABLE 6.—*Individual Measurements on Girls*—Continued*

Case	Age Yr.	Age Mo.	Ht. (Cm.)	Wt. (Lb.)	B.S.A. (Sq.M.)	Deg. of Insp.	T.D. (Cm.)	I.D. (Cm.)	C.S.A. (Sq.Cm.)	L.S.A. (Sq.Cm.)
64		1	52.00	7.75	0.215	0	5.2	9.6	14.7	15.8
		2½	57.00	10.00	0.255	1+	5.6	10.9	18.5	24.7
		6	65.00	17.25	0.355	1+	5.5	11.3	17.3	36.9
		9½	73.00	20.00	0.410	1+	6.7	14.1	29.4	48.3
	1		76.00	22.00	0.440	3+	6.0	14.9	24.6	75.4
65		1	49.00	6.50	0.190	4+	4.9	9.7	13.8	25.8
		2	54.00	9.50	0.240	4+	5.4	11.0	16.1	38.1
		3	57.00	12.00	0.275	3+	5.5	11.7	16.8	37.6
		6	66.25	16.00	0.350	3+	6.2	12.9	23.7	52.7
		10	72.50	19.00	0.400	3+	6.8	14.6	29.8	68.1
	1		75.00	19.00	0.410	3+	6.6	13.7	28.2	67.1
	1	3	78.75	22.00	0.450	1+	7.2	15.0	34.7	68.4
	1	5½	79.00	22.00	0.450	1+	7.0	14.3	28.7	63.0
	1	9	82.50	22.75	0.470	1+	7.2	15.3	32.8	78.8
	2		86.50	24.00	0.500	2+	7.6	15.3	39.2	81.8
	2	3	88.50	24.50	0.515	1+	6.9	15.4	35.4	95.4
	2	6	90.00	26.75	0.540	4+	7.4	16.8	43.9	129.5
	3		94.50	29.00	0.580	3+	7.4	16.5	42.0	107.4
	3	3	96.50	30.50	0.600	3+	7.8	16.6	48.2	119.2
	3	6	99.00	30.75	0.615	4+	7.3	16.8	43.9	127.0
	3	9	101.50	31.50	0.640	4+	7.4	16.8	40.6	123.1
	4		102.25	32.25	0.650	4+	7.6	16.5	48.6	119.0
	4	3	104.00	33.50	0.665	4+	7.3	17.2	43.3	140.1
	4	5½	106.00	34.25	0.680	4+	7.4	16.8	44.8	134.3
	4	9	107.25	35.25	0.690	4+	8.1	17.0	51.9	134.5
	5		109.25	36.00	0.710	4+	7.2	16.9	45.4	148.1
	5	2	111.00	37.25	0.725	4+	7.6	17.0	46.1	152.1
66		3	61.50	12.50	0.300	4+	5.7	12.3	21.9	46.5
		6	67.50	16.25	0.355	3+	6.1	12.5	21.1	41.9
		11	72.50	21.25	0.420	3+	6.8	14.7	30.0	66.3
	1		75.00	22.25	0.440	2+	7.4	15.4	36.5	70.1
	1	4	80.00	24.00	0.470	2+	7.8	16.4	41.5	78.5
	1	6	84.00	25.00	0.500	2+	8.1	16.9	42.0	83.0
	1	10	86.00	27.75	0.530	4+	8.0	17.4	46.0	132.4
	2		87.50	29.00	0.550	4+	7.6	17.3	41.2	122.0
	2	3	92.75	31.00	0.590	3+	7.8	18.0	41.3	115.2
	2	8	96.50	31.50	0.610	4+	8.0	17.7	48.4	154.3
	3		99.00	34.50	0.650	4+	7.7	18.3	45.8	143.3
	3	3	101.50	34.25	0.660	4+	8.4	18.5	52.9	152.4
	3	6	102.75	34.75	0.670	4+	8.2	18.0	47.9	152.1
	3	9	105.50	36.50	0.695	4+	8.4	18.3	50.6	156.7
	4		106.00	37.75	0.705	4+	8.2	18.7	54.8	164.8
	4	3	108.00	38.75	0.720	4+	8.2	18.8	52.7	165.7
	4	6	110.50	40.75	0.750	4+	8.3	18.9	54.3	177.1
	4	9	110.75	40.75	0.750	4+	8.2	19.1	56.3	175.6
	5		114.25	43.00	0.790	4+	7.8	19.3	53.2	193.0
	5	3	115.50	45.00	0.810	4+	8.3	19.2	55.5	184.8
	5	8	119.50	47.25	0.845	4+	8.6	19.8	58.2	194.0
	6	1	122.00	48.75	0.870	4+	8.7	20.2	60.5	208.5
	6	4	124.25	50.75	0.900	4+	9.0	20.0	61.0	197.1
67		1½	56.00	9.75	0.250	1+	6.0	11.5	23.7	37.6
		3	59.00	12.75	0.290	1+	6.4	12.4	26.5	41.1
		3½	60.25	12.33	0.290	0	7.0	12.3	28.7	39.8
		5	63.50	14.33	0.320	0	6.9	14.0	31.9	56.1
		9	70.50	17.75	0.380	0	7.1	15.0	32.8	65.2
	1		77.00	20.00	0.430	0	7.7	15.1	35.8	62.2
	1	3	79.00	21.66	0.450	0	7.2	15.6	33.2	72.4
	1	6	81.50	25.25	0.490	0	7.8	16.2	40.4	74.4
	1	10	86.00	27.00	0.520	0	7.9	16.4	41.8	80.4
	2		88.50	26.75	0.530	2+	6.9	16.4	32.0	104.5
	2	3	92.50	28.00	0.560	3+	7.6	17.2	40.4	107.9
	2	6	93.50	28.50	0.570	3+	7.9	17.2	44.2	120.7
	2	9	97.00	30.75	0.600	3+	7.8	16.4	41.1	103.8
	3	1	99.75	32.50	0.640	3+	8.2	17.4	46.5	118.9
	3	4	103.50	34.00	0.670	3+	8.4	17.8	50.5	131.8
	3	6	98.00	34.00	0.635	3+	8.1	17.5	48.4	139.0
	3	10¼	106.00	36.25	0.695	4+	8.1	17.8	47.3	138.8
	4	1¼	109.25	38.25	0.725	3+	7.7	18.4	43.8	163.7
	4	3½	110.50	39.50	0.740	3+	8.6	18.4	54.8	154.1
	4	6	112.33	42.00	0.770	4+	7.5	17.8	44.0	156.1
	4	9	115.00	44.25	0.800	4+	8.6	18.6	54.4	168.3
	5		116.75	44.00	0.810	4+	8.1	18.3	49.3	169.7
	5	3	119.50	45.00	0.830	4+	7.8	17.9	42.8	154.2
	5	6	120.50	48.50	0.860	4+	7.8	18.4	45.2	169.1
	5	9	123.25	49.50	0.880	4+	8.0	19.3	47.8	192.3

SUMMARY

The cardiac area, total transverse diameter of the heart, internal diameter of the chest, clavicular-diaphragmatic distance and surface area of the pulmonary fields were measured on 1,026 roentgenograms of 67 children between birth and the age of 6 years 4 months.

Height, weight, age and body surface area were recorded for each child, and complete physical examinations and electrocardiograms were made as well.

Curves depicting the growth in cardiac area and in cardiac transverse diameter, as noted in repeated examinations, show rather marked variations in each child. The variations seen in the roentgenograms of different children are even more striking.

Scatter charts of cardiac measurements plotted against height, weight, age, body surface area, internal diameter of the chest and the product of the body height and the internal diameter of the chest are discussed, and correlation coefficients for these measurements are given. In general, the scatter is greater and the standard deviation larger with measurements of transverse diameter than with those of cardiac area. It should be noted, however, that the similarities in the growth curves for cardiac area and transverse diameter of the heart for the individual child suggest that undue emphasis may have been placed on the advantages of measuring cardiac area. Since the ratio $\frac{\text{internal diameter of chest}}{\text{total transverse diameter of heart}}$ is so commonly used as an estimate of the size of the heart, a table of values for the quotient is given for the age groups up to 6 years, calculated from our data.

In using Josephi's quotient of $\frac{\text{body surface area}}{\text{cardiac area}}$ on our data it was found that only 73.6 per cent of the values fell within Josephi's published range, 22.4 per cent being above his normal limits.

In using von Bernuth's quotient of $\frac{\text{height} \times \text{internal diameter of chest}}{\text{cardiac area}}$ it was found that 93.5 per cent of our values fell within his normal range, with 3.7 per cent above and 2.7 per cent below.

Somewhat wider normal ranges are suggested for Josephi's quotient, especially during the earlier years.

BASAL METABOLISM OF UNDERNOURISHED GIRLS

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Undernutrition is a relatively common clinical condition, which may accompany or follow acute or chronic illness, faulty food habits, indigestion or any type of underfeeding. It is seen in combination with many pathologic conditions in varying degrees of severity. There are few diseases in the course of which the diet is not restricted at one time or another, either by the physician or involuntarily by the patient. It is not possible to differentiate the various grades of undernutrition definitely, because of the great number of individual variations in type of body build. The only method which offers any means of comparison is based on the relation of the weight to the expected weight for the height. Although this method is open to criticism, it serves a useful purpose until a better one is devised and probably gives a fairly accurate picture of the physiologic state of the child.

Although no definite point has yet been fixed separating normal physical development from malnutrition, it is the usual custom to classify as undernourished those children whose weight is more than 10 per cent lower than the expected weight for the height (Baldwin-Wood height-weight standard). This arbitrary line of division was made with full appreciation of the fact that some children whose weight falls inside it may be undernourished and that others whose weight is outside have normal physical development.

My co-workers and I [1] recently presented simple standards for predicting the heat production of children, which differ in their point of view from those commonly in use. They include data which fill in the blank spaces for older children and make it possible to study the metabolism of children who have passed puberty. The results obtained with the standards for boys and girls [2] differ from those obtained with the body surface standards and are believed to be consistent with the physiologic status of the body. The standard total calories for the weight is the one that should be used in most cases, but for children

1. Talbot, F. B.; Wilson, E. B., and Worcester, J.: Standards of Basal Metabolism of Girls (New Data) and Their Use in Clinical Practice, J. Pediat. **7**:655, 1935.

2. Talbot, F. B.: Basal Metabolism Standards for Children, Am. J. Dis. Child. **55**:455 (March) 1938.

with an abnormal body build, especially when it is caused by undernutrition, the total calories for the height must also be consulted. The latter standard actually gives the metabolism for the "expected weight," because each height gives the heat production of the average, or expected, weight for that height. The terms calories for the height and calories for the expected weight will be used interchangeably in this paper.

This study of undernutrition is based on the premise that the body is composed of two main types of tissue, of which one produces heat and the other does not. The former, which may be called active tissue, includes muscle and possibly organs, while the latter, known as inactive tissue, includes bone, water and fatty tissue.

The problem of malnutrition will be considered in two parts: acute malnutrition, such as is seen in fasting subjects, and chronic malnutrition.

*Basal Metabolism During Fasting**

Patient	Age, Yr.	Weight, Kg.		Duration, Days	Pulse Rate		Blood Pressure		Total Calories	
		Before Fast	After Fast		Before Fast	After Fast	Before Fast	After Fast	Before Fast	After Fast
P. G.	1½	32.0	29.0	8	98	76	108/82	98/76	1,306	985
C. P.	13	33.4	30.9	7	90	80	110/90	108/88	1,305	1,031
W. P.	11	31.4	26.5	14	83	52	120/74	108/82	1,425	930

* Based on data from Talbot, F. B.; Dalrymple, A. J., and Hendry, M. F.: Skin Temperature and Basal Metabolism During Fasting, Am. J. Dis. Child. **30**: 491 (Oct.) 1925.

RAPID LOSS OF WEIGHT—ACUTE MALNUTRITION

The accompanying table shows the effect of rapid loss in weight on the metabolism of children who fasted during a treatment for idiopathic convulsions.

The metabolism was reduced proportionately with the temperature of the skin and of the body and with the pulse rate. This may be taken as evidence that body heat is conserved during fasting. Sudden loss of weight takes place generally during the course of an acute disease, but it also accompanies any illness during which the intake of food is markedly reduced or no food is taken. A survey of the data available in the literature shows that children convalescent from acute illness also have lowered metabolism,[3] which may continue for from one to several weeks.

CHRONIC MALNUTRITION

Slow loss of weight, or chronic malnutrition, is seen during famines or serious economic disturbances, in chronic diseases or indigestion and in children with bad food habits. It may result from too great activity without sufficient extra food to support it.

3. Schick, B., and Cohen, P.: Lowered Basal Metabolism, in Postinfectious Stages and in Diseases Characterized by Slow Pulse Rate, Am. J. Dis. Child. **30**: 291 (Sept.) 1925.

The work of Fleming,[4] Talbot[5] and Levine[6] indicates that with a deficit of 20 per cent or more in body weight in infants there usually is a diminished total heat production and that with a loss greater than 30 per cent there is always an absolute reduction in the amount of heat produced.

Murlin,[7] commenting on the energy metabolism of malnourished children, said, "It would be of special interest to recalculate all these results on the basis of unit of expected weight." This has been done by comparing the metabolism of older underweight children with the standard heat production for the height.

Talbot, Wilson and Worcester[8] made a statistical study of 189 underweight girls of from 8 to 18 years. Part of the data were collected from the literature and the balance from Dr. Stark's, Dr. Lucas's and my unpublished cases. These have been plotted to show graphically the relation of the heat production to that of average normal girls.

In the block marked with diagonal lines, chart 1 shows the distribution of the metabolic rates of normal girls, viz., those whose weights are between 20 per cent more and 10 per cent less than the expected weight for the height. The group whose weight was between 10 and 20 per cent below the expected weight show a similar distribution but with more values falling below the standard than above. Statistically,[8] the metabolic rates of the normal girls averaged —7.2 per cent. In the group whose weight is more than 20 per cent lower than the expected weight, the heat production is decidedly lower, averaging —10.4 per cent. There is a trend for the heat production to diminish in older children, as it does in infants, when the undernutrition becomes severe. When Topper's[9] cases are charted separately this trend becomes more obvious and definite. N. B. Talbot[10] has shown by means of the creatinine index that the muscles compose 27 per cent of the weight

4. Fleming, G.: Investigation into Metabolism in Infantile Atrophy, with Special Reference to the Respiratory Exchange, Quart. J. Med. **14**:171, 1921.

5. Talbot, F. B.: Severe Infantile Malnutrition Energy Metabolism, with Report of a New Series of Cases, Am. J. Dis. Child. **22**:358 (Oct.) 1921.

6. Levine, S. Z.; Wilson, J. R., and Gottschall, G.: Respiratory Metabolism in Infancy and in Childhood, Am. J. Dis. Child. **35**:615 (April) 1928; **36**:740 (Oct.) 1928.

7. Murlin, J. R., in Growth and Development of Children: III. Nutrition, White House Conference on Child Health and Protection, New York, Century Company, 1932, sect. 1, p. 365.

8. Talbot, F. B.; Wilson, E. B., and Worcester, J.: Basal Metabolism of Girls: Physiologic Background and Application of Standards, Am. J. Dis. Child. **53**:275 (Jan., pt. 2) 1937.

9. Topper, A., and Mulier, H.: Basal Metabolism in Children of Abnormal Body Weight: In Underweight Children, Am. J. Dis. Child. **38**:299 (Aug.) 1929.

10. Talbot, N. B., and Broughton, F.: The Measurement of Obesity by the Creatinine Coefficient, Am. J. Dis. Child. **55**:42 (Jan.) 1938.

of average normal children, as much as 50 per cent of lean children and as little as 10 per cent of emaciated children. His figures show that while variation in weight from the normal for height and age reflects average changes in the relative amount of muscle, exceptions are encountered. This difficulty may be eliminated by measuring the creatinine coefficient, which is an accurate index of the amount of muscle in the body.

When these data are compared with standards of heat production in which weight enters into the calculation, the metabolism averages

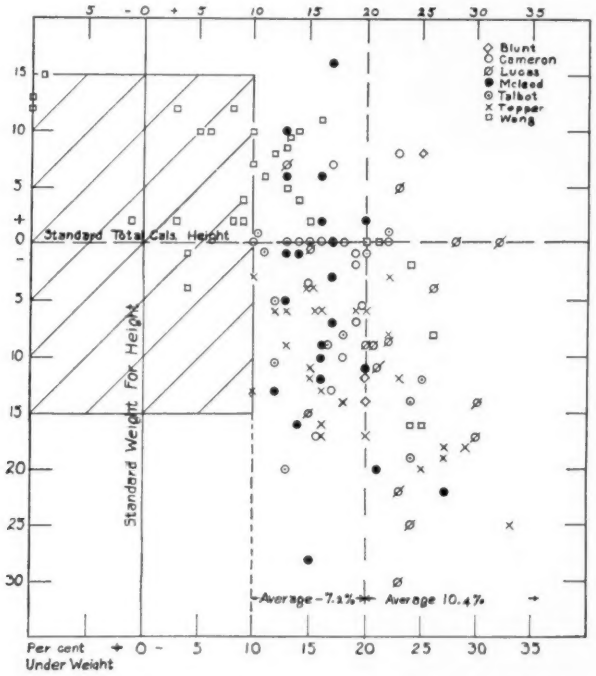

Chart 1.—Relation of heat production of underweight girls to that of average normal girls.

3.8 per cent above normal. This is illustrated in chart 2, in which the metabolic rates in Topper's [9] cases and Wang's [11] cases are plotted against weight.

The data presented show how interpretation of the metabolic rates associated with undernutrition in childhood can be affected by the type of standard used. Since undernutrition complicates many types of disease, it is important that the reason for this should be understood and

11. Wang, Chi Che; Frank, M.; Hayes, B. B., and Kern, R.: Metabolism of Undernourished Children: I. Gain in Weight, Am. J. Dis. Child. **32**:63 (July) 1926; Basal Metabolism, ibid. **32**:350 (Sept.) 1926.

that a relative or a seeming increase in heat production should not be mistaken for an absolute increase. This point has not been made clear in the literature, which leaves one with the impression that some authorities believe that undernutrition is accompanied by an increase in heat production. The data presented here are given as evidence that the reverse is the case, that in place of what appears to be an increase in total heat production there is an absolute decrease.

A lean normal child may have a metabolic rate which appears high when computed according to the body surface and the weight standards if his total heat production does not diminish in proportion to the loss of weight. During acute undernutrition a disproportion between the reduction in total heat production and the loss in weight is to be expected,

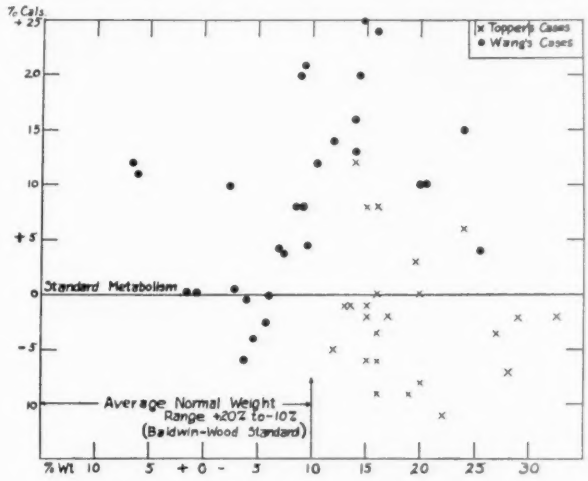

Chart 2.—Metabolic rates plotted against weight.

because the primary loss in weight is due mainly to loss of fat and water and not to loss of heat-producing tissue. In the later stages of fasting, when muscle, or heat-producing tissue, is also lost, there may no longer be such a disproportion.

Undernutrition is commonly seen in clinical practice and often complicates many other conditions for which the basal metabolism test is used as a diagnostic procedure. It is my belief that mistaken and unwarranted conclusions will be drawn from tests which are interpreted without consideration of the principles outlined. This conclusion is based both on the data presented here and on the clinical progress in the cases studied.

The effect of obesity on the heat production is the reverse of the effect of undernutrition and will be discussed in a future communication.

CONCLUSIONS

1. During acute undernutrition there are a rapid loss of weight and a corresponding lowering of the heat production.

2. Severe chronic undernutrition is associated with a lowered production of heat. The greater the degree of malnutrition the less the heat production of the body.

3. The teaching that malnutrition is accompanied by increased heat production resulted from the error of using standards for metabolism which divide the total amount of heat produced by body weight, or by body surface when weight is used in the formula. Results obtained with such standards are only relative and do not give evidence of the true physiologic status.

4. The heat production of girls who are between 10 and 20 per cent below their normal weight averages 7.2 per cent less than the total calories for the expected weight as shown by the height standard. With more severe malnutrition the heat production averages 10.4 per cent less than the total calories for the expected weight and may be as low as —27 per cent below that value.

5. Even though the absolute heat production is diminished, it may appear to be increased if there is a greater proportional loss in inert tissues than in heat production. When standards are based on body weight, as is the case with body surface standards and the "multiple prediction formula," the metabolism will appear to be increased or diminished according to the composition of the weight lost. In order to obtain a knowledge of the true state of affairs in malnutrition, the absolute total heat production should be compared with standards expressed in the terms of expected average weight for the height. This can be done simply by using the height standard.

SERUM CHOLESTEROL IN PATIENTS WITH RHEUMATIC FEVER

FURTHER STUDY

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In a previous study of serum cholesterol values for children [1] the following results were reported: The mean total cholesterol value (with standard deviation) was 183.7 ± 38.7 mg. per hundred cubic centimeters; the free or uncombined cholesterol amounted to 50.6 ± 10.3 mg.; the mean percentage of free cholesterol was 27.4 ± 1.5.[2] These values were obtained for a series of 325 determinations on three groups of patients (from 2 months to 12 years of age). The children were grouped thus: (*a*) those admitted to the hospital for tonsillectomy and adenoidectomy; (*b*) those with miscellaneous acute and chronic diseases, and (*c*) those suffering with rheumatic fever in any of its manifestations. It was noted that the means and standard deviations for the serum cholesterol values in these subgroups were similar to each other. For the patients with rheumatic fever the mean total cholesterol value was 183.7 ± 33.9 mg.; the mean free cholesterol value was 50.2 ± 9.1 mg., and the mean percentage of free cholesterol was 27.3 ± 3.5.

The homogeneous results obtained by standard statistical analysis were offered as evidence of the mass stability of serum cholesterol values, especially of the percentage of free cholesterol. However, as noted in this preliminary publication, repeated weekly determinations for various patients with rheumatic fever, although finally adding up to give the means just stated, were often different for the same child. The material thus presented was gathered during the summer of 1935 at the Seaside Hospital of the St. John's Guild. During the corresponding period of 1936, I made successive determinations of serum cholesterol for the patients with rheumatic fever, several patients who were under observation in 1935 being included. The previous findings were corroborated, and the fluctuations in successive determinations on the same child were again noted. When the larger group of data was reviewed, however, it became evident that these changes often followed

From the Seaside Hospital, St. John's Guild, Staten Island, N. Y., and the Newark City Hospital.

1. Offenkrantz, F. M., and Karshan, M.: Serum Cholesterol Values for Children, Am. J. Dis. Child. **52**:784 (Oct.) 1936.

2. In previous work, the ratio free cholesterol/esterified cholesterol has been used to express the subdivision of the total cholesterol. Here the percentage of free (within the total) cholesterol is used.

definite patterns when they were correlated with clinical and laboratory evidence of the status of infection.

It must be understood that the rheumatic condition is considered as a continuous state of infection with exacerbations and remissions.[3] The clinical histories illustrated the tenacity of the disease, most of them being of several years' duration. What is the mechanism of the flare-up in cases of rheumatic infection? It has been attributed to exogenous reinfection, to endogenous reinfection and to allergic reactivity. Since all of these must be considered as possibilities, the following discussion of the literature on cholesterol which concerns these items is timely.

The deviation of blood cholesterol values from normal levels in cases of acute and chronic disease has long been a matter of record. In the past, however, studies on cholesterol have usually dealt with the total values, without partition into esterified and uncombined fractions. More recently, an increasing number of investigations have included this subdivision of the total cholesterol. As to the infections themselves, Boyd [4] has shown that at the onset of an infectious fever there is temporary hyperlipemia, the total cholesterol level going up slightly, owing to a rise in the free cholesterol, while the ester form remains the same, the percentage of free cholesterol thus being elevated. During the acme of the fever a marked lipopenia develops, with a great drop in the percentage of free cholesterol. Boyd attributed these changes in part to an excessive removal of transport fats from the plasma by active body tissues. By obtaining lipid partitions in a group of cases of infectious conditions Boyd [5] showed that slowly rising levels of phospholipids and free cholesterol foreshadowed uneventful recovery. However, if there was delayed convalescence or complications, the level of phospholipids often fell, while the ester fraction was present in increased amounts. On the basis of additional work [6] and of the studies of Bloor and others on corpora lutea,[7] Boyd postulated that physiologic activity of a tissue can be determined by finding such a rise in the level of free cholesterol or phospholipids while the value of the ester fraction falls. This concept will be reviewed later in connection with response on the part of rheumatic patients. Working with syphilitic patients

3. Cecil, R. L.: A Text-Book of Medicine, ed. 4, Philadelphia, W. B. Saunders Company, 1937.

4. Boyd, E. M.: Lipopenia of Fever, Canad. M. A. J. **32**:500 (May) 1935.

5. Boyd, E. M.: Post-Operative Activity of White Blood Cells as Measured by Their Lipid Content, Canad. M. A. J. **31**:626 (Dec.) 1934.

6. Boyd, E. M.: Lipid Composition and Physiological Activity in the Ovaries of Pregnant Guinea Pigs, J. Biol. Chem. **112**:591 (Jan.) 1936; Lipid Composition of White Blood Cells in Women During Pregnancy, Lactation, and Puerperium, Surg., Gynec. & Obst. **59**:744 (Nov.) 1934.

7. Bloor, W. R.; Okey, R., and Corner, G. W.: Relationship of Lipids to Physiological Activity, J. Biol. Chem. **86**:291 (March) 1930.

(primary, secondary and tertiary stages), Feraru of Offenkrantz [8] were able to show that the primary and secondary stages were accompanied by a fall in the total cholesterol level with a rise in the percentage of free cholesterol, while the tertiary stage was associated with a higher blood cholesterol level. This indicated that there was acute infection in the primary and secondary stages.

The relation between cholesterol levels and response to infection is described in the comprehensive review by de Lavergne and Kissel.[9] They expressed full agreement with other competent French workers that during the course of infection the time of the lowest blood cholesterol level is the point of lowest resistance to the infecting organism. This is associated with the vital water balance of the body, as shown by the observation that for each individual cell the cholesterol therein—either free or ester—regulates the imbibition of water. "If the constant, K, of the imbibition of water into a cell is correlated with all of the material constituting cellular elements, it most closely corresponds with the amount of cholesterol." The adrenals are named the mother lode of cholesterol reserve; however, no adequate explanation of the mechanism of their activity is offered. These workers stated the belief that destruction of or severe activity by cells liberates cholesterol from them. The blood stream conducts the cholesterol from the dying cells to points of construction of new cells, acting throughout only as a carrier. Infection, therefore, should be marked by hypercholesteremia, which was actually found to be the case in experimentally infected rabbits, without fever. However, the mechanism of fever (unexplained) is conducive to hypocholesteremia, which is present until the fever disappears and the true hypercholesteremic picture appears. Destruction of red blood cells is probably the most potent cause of hypercholesteremia.[10] This is related most definitely to the (experimentally shown) protection of red blood cells by cholesterol; when this substance is lost to the cells, they are destroyed.

The work of Stoesser and McQuarrie is of importance in a consideration of changes in the cholesterol level that occur during infectious states. They [11] showed that the total lipid content of the blood varies inversely as the leukocyte count during the course of acute infection or

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8. Feraru, F., and Offenkrantz, F. M.: Serum Cholesterol in Syphilis, Am. J. Syph., Gonor. & Ven. Dis. **21**:267 (May) 1937.

9. de Lavergne, V., and Kissel, P.: Cholestérol et immunité, Rev. d'immunol. **1**:341 (May) 1935.

10. de Lavergne, V., and Kissel, P.: Hémolyse microbienne et cholestérologenèse. Etude in vitro, Compt. rend. Soc. de biol. **114**:1014, 1933.

11. Stoesser, A. V., and McQuarrie, I.: Influence of Acute Infection and Artificial Fever on Plasma Lipids, Am. J. Dis. Child. **49**:658 (March) 1935.

artificial fever. Stoesser [12] noted that there was a fall in the total cholesterol level at the height of an acute infection as compared with the level in the same patient during the convalescent period. The actual fall occurred in the esterified fraction, while the free cholesterol remained relatively unchanged, the result being a rise in the percentage of free cholesterol. Lastly, Bokrétás,[13] using accurate technics, found that during the febrile period the cholesterol content of the leukocytes is normal. After the febrile period this cholesterol content reaches a maximum value. If, however, the maximum is reached during the febrile period, the patient probably will not recover. His experimental data were obtained on patients with typhoid fever and pneumonia.

Does the alteration in blood cholesterol levels constitute a definite factor in the defense mechanism of the patient? A group of European workers [14] vaccinated a series of rabbits against smallpox. At first there was hypocholesteremia, and this was followed by hypercholesteremia. The first response occurred at the time of the greatest antigen activity in the organism; the inference was that depletion of cholesterol in the blood effected an antibody response. In animals with a weak antibody response the cholesterol in the blood stream is apparently delayed in going from the decreased to the increased state. Workers at the Rockefeller foundation were able to show [15] that when cholesterol is added to antipneumococcus horse serum the protective action of this serum against pneumonia in mice is definitely reduced. From this and other findings it was concluded that lipids participate selectively in the antigen-antibody reaction. The phenomenon of the antigen-antibody reaction is complex, however, and side by side with the fact of infection is the question of allergic response. Von Babarczy [16] recorded that in cases of experimental tuberculosis, either increased activity of the process or increased sensitivity to tuberculin causes lowering of the blood cholesterol level. However, if either of these processes is at any time marked by great destruction of tissue, at such a time the blood cholesterol level will rise. Paul [17] reported a series of interesting physiochemical experi-

12. Stoesser, A. V.: Study of Cholesterol Fractions in Acute Infections, Proc. Soc. Exper. Biol. & Med. **32**:1324 (May) 1935.

13. Bokrétás, A.: Variations in the Cholesterol Content of White Blood Cells in Acute Infectious Diseases, Orvosi hetil. **80**:1164 (Dec. 5) 1936.

14. Grechko, V. A.; Kolomoytsev, L. R., and Lisovskiy, A. E.: Changes in Cholesterol of Blood After Vaccination Against Typhoid, Eksper. med., June 1936, p. 109.

15. Goodner, K., and Horsfall, F. L.: Protective Action of Type I Antipneumococcus Serum in Mice, J. Exper. Med. **64**:469 (Sept.) 1936.

16. von Babarczy, M.: Ueber die Determinanten des Blutcholesterins bei Lungentuberkulose, Beitr. z. Klin. d. Tuberk. **85**:9, 1934.

17. Paul, B.: Saturation of Blood with Cholesterol in Allergic Diseases, abstracted, Orvosi hetil. **77**:444 (May 27) 1933.

ments, in which he found the blood serum to be supersaturated with cholesterol during various allergic conditions.

An attempt will later be made to integrate my findings with this background of experimental data. At the moment, however, certain items which show direct correlation are important. In the present study the erythrocyte sedimentation rate was an excellent index of the activity of disease. Swedin [18] reported that many animals with various infectious diseases show an inverse ratio between the sedimentation rate and the blood cholesterol level. Hartung and Bruger [19] found extremely low cholesterol values to be associated with elevated sedimentation rates; however, they could find no constant correlation. Noteworthy is their assertion that they could find no alteration in the relation between free and esterified cholesterol. Of scientific curiosity is the study by Rix,[20] who used rabbits to discover that the rate of erythrocyte sedimentation was accelerated by administration of linseed oil but that if cholesterol was added to the linseed oil there was a diminution in the rate of sedimentation.

The only contemporary study of plasma lipids in children with rheumatic disease is that of Kaiser and Gray,[21] who found that in 43 rheumatic patients the mean total cholesterol values closely approached the mean values in normal children. These values, determined on specimens of blood taken during fasting, showed absolutely no correlation with carefully analyzed diets ingested by the subjects. This permitted the conclusion that diet, especially the lipid portions, does not affect the plasma cholesterol levels. Of particular importance is the fact that in 3 cases in which subsequent determinations were made there were the significant variations shown by many in my series. However, Kaiser and Gray offered no explanation of these individual variations.

As in all of my previous studies of cholesterol the method employed was that of Schoenheimer and Sperry,[22] as modified for the colorimeter by Fitz.[23] The color standard devised by Shapiro and others [24] was

18. Swedin, B.: Plasmaeiweiss, Cholesterin und Senkungsreaktion bei verschiedenen Tierarten, abstracted, Biochem. Ztschr. **257**:411 (Jan. 28) 1933.

19. Hartung, E. F., and Bruger, M.: Cholesterol Content of Plasma in Arthritis, J. Lab. & Clin. Med. **20**:675 (April) 1935.

20. Rix, E.: Die Beziehung der Senkungsgeschwindigkeit der roten Blutkörperchen des Kaninchens zum Cholesteringehalt, zu den Kationen und dem Albumin-Globulin-Quotienten des Blutserums, Ztschr. f. d. ges. exper. Med. **99**: 178, 1936.

21. Kaiser, A. D., and Gray, M. S.: Blood Lipids in Children with Scarlet Fever and Rheumatic Disease, Am. J. Dis. Child. **47**:9 (Jan.) 1934.

22. Schoenheimer, R., and Sperry, W. M.: Micromethod for the Determination of Free and Combined Cholesterol, J. Biol. Chem. **106**:745 (Sept.) 1934.

23. Fitz, F.: Application to Colorimeter of Schoenheimer and Sperry Method for Determination of Total and Free Cholesterol, J. Biol. Chem. **109**:523 (May) 1935.

24. Shapiro, A.; Lerner, H., and Posen, E.: Fixed Color Standard for Cholesterol Determinations, Proc. Soc. Exper. Biol. & Med. **32**:1300 (May) 1935.

used. Blood was obtained by venipuncture and was stored in a refrigerator, and serum was obtained for analysis by a procedure described previously.[1] During the two summers 100 rheumatic subjects were studied, for whom 225 determinations of serum cholesterol were performed. Historical evidence of rheumatic infection was always available, especially since most of these patients came from hospitals where complete investigation had been undertaken. At Seaside Hospital they were classified by clinical examination with regard to activity of the rheumatic process. In addition, confirmatory laboratory evidence was obtained in the form of repeated erythrocyte sedimentation rates, electrocardiograms, leukocyte counts, studies of red blood cells and hemoglobin, etc. For these patients, as for all those admitted to this institution, routine Schick and Mantoux tests were done, with roentgen investigation of those patients whose Mantoux test gave a positive reaction.

Of the 100 children, 49 were subgrouped as a control series. These showed no signs of rheumatic activity at the time of the determination of cholesterol, the erythrocyte sedimentation rate for each child being less than 12 mm. per minute and the white count not going above 10,000 per cubic millimeter, with a differential count appropriate to the child's age. No patient was finally included as a control who suffered a clinical relapse to a condition below the average of the entire group, or whose electrocardiograms showed evidence of increasing cardiac damage. Most of the members of this control group had apparently suffered only mild infection, with a paucity of flare-ups, prior to their admission to Seaside Hospital. The mean value of the total serum cholesterol for this group was 181.9 ± 23.5 mg. per hundred cubic centimeters; the mean free cholesterol value was 50.5 ± 7.4 mg., while the percentage of free cholesterol was 27.3 ± 2.23. Again can be seen the stability of mean cholesterol values when a standardized technic is used. The standard deviation of 23.5 mg. shows a noteworthy diminution from the previously reported deviation of 33.9 mg. for the entire earlier series.

Attention is now called to the 51 patients whose progress or regression over a period of time is the focus of this study. The 178 determinations were distributed so that certain patients had as many as 8 over the two summers. The intervals between determinations were at least one week. The most striking findings concern the 5 patients who died. The values of total serum cholesterol, determined within one day of death or (by cardiac puncture) within ten minutes of death, ran as follows: 117.8, 109.4, 97.9, 84.2 and 67 mg. The percentages of free cholesterol of these totals were 40, 32.3, 35.7, 32 and 35, respectively. These figures cannot be interpreted but to mean a severe depletion of cholesterol ester at the time of death. The most instructive

case of the group was that of an 11 year old girl, who went steadily downhill (case 1). Data for this case are as follows:

Date*	Free C.†	Total C.†	% Free C.†	E. S. R.‡
7/ 4	42.8	157.0	27.2	8
7/10	42.0	141.2	29.7	12
7/18	38.1	111.5	34.4	17
8/ 1	36.4	109.0	33.3	36
8/ 9	33.9	98.0	34.7	51
8/16	30.1	84.2	35.7	68

* Dates on which determination was performed; month and day are given for the purpose of comparing the periods of time.
† Cholesterol.
‡ Erythrocyte sedimentation rate.

Next is presented a group of 11 cases in which the serum cholesterol values tended to remain below the mean throughout repeated determinations. All patients had negative Schick and Mantoux reactions. The rheumatic condition was considered as active throughout the period of study (the cardiac insufficiency was maintained fully compensated by proper management), without much change. The abbreviated case histories and cholesterol findings of this group follow:

Case 2, 8 yr., male; class I; mitral insufficiency

Date	Free C.	Total C.	% Free C.	E. S. R.	
6/26	42.6	117.8	36.1	44	Red cell count 4.1 m.; hb., 62%; leukocyte count, 10,400, polym. 62%

Case 3, 7 yr., male; class IIa; mitral insufficiency

7/14	48.7	147.0	33.1	58	Red cell count, 3.82 m.; hb., 60%; leukocyte count, 12,000, polym. 71%

Case 4, 9 yr., female; class I

7/ 5	35.8	122.3	29.2	53	Red cell count, 4.62 m.; hb., 70%; leukocyte count, 9,300, polym. 66%

Case 5, 6 yr., male; class IIb; mitral insufficiency and stenosis

7/24	38.6	128.4	30.1	27	Red cell count, 4.24 m.; hb., 85%; leukocyte count, 7,200, polym. 41%
7/31	36.2	124.9	29.1	34	

Case 6, 9 yr., male; class IIb; mitral and aortic insufficiency and stenosis

6/18	34.7	130.8	26.5	28	Red cell count, 4.8 m.; hb., 88%; leukocyte count, 14,200, polym. 70%
6/25	44.1	138.1	31.9	34	

Case 7, 7 yr., female; class IIa; mitral insufficiency

6/15	43.4	137.1	31.6	25	Red cell count, 4.47 m.; hb. 86%; leukocyte count, 9,800, polym. 68%
7/15	38.7	119.1	32.3	25	
7/22	32.2	100.0	32.2	48	

Case 8, 10 yr., male; class IIa; mitral insufficiency and stenosis, aortic insufficiency

6/15	42.8	136.3	31.4	30	Red cell count, 4 m.; hb., 65%
6/25	34.6	108.5	31.8	78	Leukocyte count, 10,600, polym. 70%
7/22	35.5	110.8	31.8	78	
7/29	40.1	138.3	29	62	
8/ 7	41.2	130.9	31.3	64	

Case 9, 12 yr., female; subacute bact. endocarditis, mitral insuf. and stenosis

7/28	37.8	115.3	32.8	124	Positive blood culture
8/ 5	39.2	109.1	35.2	134	Positive blood culture
8/12	40.8	98.9	40.1	110	Positive blood culture

Case 10, 11 yr., male; class I; mitral insuf. and stenosis, aortic and tricuspid insuf.

7/ 4	52.5	150.6	34.7	44	Red cell count, 4.16 m.; hb., 70%
7/18	42.9	148.6	28.9	46	
8/ 1	49.0	150.9	32.4	50	
8/ 9	46.4	152.8	30.3	50	

Case 11, 7 yr., female; class IIb; mitral insufficiency

7/ 8	40.5	127.4	31.7	48	Red cell count, 4.68 m.; hb., 75%; leukocyte count, 14,000, polym. 70%
7/15	32.5	110.8	29.3	45	
7/22	39.2	121.5	32.0	48	Leukocyte count, 12,750, polym. 64%
8/ 5	40.5	124.1	32.4	40	

The data just given are those of patients whose condition did not fluctuate severely throughout the period of observation. These children were sick, though the cardiac insufficiency was compensated. The low values for total cholesterol, the inadequacy of which seemed to occur in the ester form, are in keeping with the previous concept of cholesterol levels in patients with acute infections.

I come now to a series of patients whose condition showed sharp fluctuation with regard to the disease, but without demonstrable congestion of the liver or functional failure of that organ. The Mantoux and Schick tests here also gave negative results.

The term flare-up is used here to indicate a relapse in ordinary rheumatic convalescence, with elevated pulse and respiration rates and usually an increase in temperature. The most instructive fact in the case histories is the type of change which occurred: i. e., the fall in the total cholesterol level during the flare-up, the fall being due chiefly to the diminution of cholesterol ester, as is shown by the rise in the percentage of free cholesterol.

Case 12, 10 yr., female; mitral and aortic insufficiency; mitral stenosis

Date	Free C.	Total C.	% Free C.	E. S. R.	
6/18	37.5	122.3	30.6	101	
6/25	36.2	122.0	29.9	112	Leukocyte count, 19,000, polym. 71% temp., 102 F.
7/ 8	46.8	170.0	27.5	35	Leukocyte count, 8,250, polym. 58%; temp., 101.1 F.
7/15	45.9	172.8	26.5	25	
7/22	43.5	142.0	30.6	48	
7/29	48.1	150.1	32.1	51	Leukocyte count, 12,600, polym. 72%; temp., 101.6 F.; temp., 100 F.
8/ 5	54.2	180.0	30.1	30	

Case 13, 7 yr., female; mitral insufficiency and stenosis; no active flare-ups but mild changes in the condition

7/27	51.9	210.2	24.7	33	
8/ 1	43.8	152.9	28.4	40	Leukocyte count, 13,100, polym., 69%; temp., 101.8 F.
8/9	45.0	171.0	26.9	20	

Case 14, 11 yr., male; aortic insufficiency; single flare-up

7/23	44.2	190.4	23.1	24	
8/ 4	58.7	178.1	32.9	43	Red cell count, 5 m.; hb., 85%; leukocyte count, 15,200, polym., 66%

Case 15, 12 yr., male; mitral insufficiency and stenosis; this patient had a single flare-up and is thus included in this group; however, the values are not totally consistent with the concept of fluctuations

6/13	65.6	218.9	29.8	8	
7/ 3	50.6	150.2	33.5	20	Red cell count, 3.84 m.; hb., 54%
7/17	54.8	222.1	24.7	17	
7/24	46.8	187.1	24.9	18	
7/31	49.6	188.6	25.0	22	

Case 16, 11 yr., female; mitral insufficiency and stenosis; patient observed during two summers

7/10*	48.2	178.5	27.0	22	Red cell count, 3.86 m.; hb., 61%; leukocyte count, 11,800, polym. 67%
7/17	51.4	189.7	27.8	13	
8/ 1	53.8	196.6	28.8	11	
7/15	51.8	167.9	30.5	18	Red cell count, 4.22 m.; hb., 76%
7/23	40.2	162.1	24.7	8	Leukocyte count, 8,400, polym. 53%

* When dates seem duplicated with subdivision noted, the first group of dates refers to 1935 and the second group to 1936.

Case 17, 12 yr., male; mitral and aortic insufficiency; mitral stenosis; patient was fairly ill on admission but improved rapidly

8/ 5	46.4	164.0	28.1	41	Leukocyte count 12,800, polym. 50%; temp., 102.2 F.
8/20	50.9	205.9	24.7	18	Red cell count, 5.1 m.; hb., 89%; temp., 100.6 F.; pulse, 76

Case 18, 7 yr., female; mitral insufficiency; chorea; this patient was given a series of injections of typhoid organisms for creation of an artificial fever

7/19	66.7	250.5	26.6	12	Before typhoid therapy
8/ 8	58.2	197.2	29.8	31	After typhoid therapy

Case 19, 7 yr., female; class IIb; mitral insufficiency and stenosis

7/16	65.8	297.6	22.1	87	Red cell count, 4.24 m.; hb., 79%
7/24	52.2	177.4	29.8	94	
7/31	56.9	174.4	32.6	100	Leukocyte count, 18,800, polym. 76%
At Babies' Hospital:					
10/18	66.8	262.7	25.7		

Case 20, 10 yr., male; aortic insufficiency

7/18	45.6	154.6	29.4	44	
8/ 4	63.1	195.5	32.2	20	

Case 21, 9 yr., female; chorea; this patient was given diphtheria toxoid during her stay; this may have influenced the cholesterol levels

7/ 1	44.0	176.3	24.9	35	Red cell count, 4.26 m.; hb., 88%; leukocyte count, 10,000, polym. 68%
7/16	54.4	198.4	26.9	25	
7/30	47.4	171.8	23.3	38	

Case 22, 7 yr., female; in addition to his rheumatic state, this patient had polydipsia and polyuria, but no other symptoms that would justify an additional diagnosis

8/ 5	52.8	200.0	26.4	18	
8/25	41.4	184.0	22.5	11	

Case 23, 8 yr., female; mitral insufficiency and stenosis

6/18	49.2	193.9	25.3	35	Red cell count, 3.81; hb., 67%
6/25	51.3	201.2	24.4	31	
7/15	57.1	181.4	31.5	87	Leukocyte count, 13,600, polym. 73%; temp., 103 F.
7/23	52.5	157.5	33.3	98	Leukocyte count, 16,800, polym. 87%; temp., 102 F.
7/30	47.2	155.5	30.3	64	Temp., 101.6 F.
8/ 5	45.5	173.9	26.1	20	
8/12	56.9	205.6	27.6	21	

The next group of cases is that of the patients with evidences of cardiac decompensation as a manifestation of the rheumatic process. In all of these children marked myocardial damage was shown by electrocardiographic study. In all decompensation was observed at certain periods of their hospitalization. This finding was obtained, as usual, by clinical examination, and it should be noted that the liver margin was palpable at various levels below the costal margin. The swollen, inefficient liver in these cases gave a correlative factor of great importance, in view of the important role of the liver in adjusting the cholesterol levels of the blood. It is admitted that there was no uniform pattern of blood cholesterol changes throughout this series of observations, but certain facts may be adduced from a study of the individual cases. The most noteworthy fact is that when the liver is decompensated, increased activity of the rheumatic process (flare-up) is not always accompanied by the previously noted rise in the percentage of free cholesterol. As the total cholesterol level often falls during these conditions, it must be concluded that the levels of both the free and the ester form are lowered, rather than chiefly that of the ester, as in the case in which there is no failure of the liver.

Case 24, 9 yr., female; mitral insufficiency and stenosis; heart failure on right and left; observed for two summers; progressive downhill course

Date	Free C.	Total C.	% Free C.	E. S. R.	
7/18	39.9	144.3	27.7	23	Liver down to umbilicus; red cell count, 3.86 m.; hb., 70%; leukocyte count, 12,400, polym. 68%
7/25	49.9	200.1	24.4	16	Liver only 1 fingerbreadth below costal margin
8/ 1	67.8	237.1	28.6	25	
8/ 8	58.2	197.2	29.9	26	Leukocyte count, 10,800; polym. 65%
7/15	34.4	120.0	28.6	38	Liver enlarged throughout this period
7/22	33.1	118.7	27.8	28	Leukocyte count, 11,200, polym. 71%
8/ 5	35.2	113.8	30.8	10	Marked decompensation; very sick, with gradual passage into moribund state

Case 25, 11 yr., female; mitral insufficiency and stenosis

7/ 3	51.3	176.0	29.2	7	Red cell count, 5 m.; hb., 80%; leukocyte count, 14,000; liver 3 fingerbreadths below costal margin
7/10	31.72	128.9	24.3	20	
7/18	53.0	196.3	27.0	8	Liver as on 7/3
7/31	46.3	190.2	24.1	4	Liver not palpable below costal margin
8/ 9	49.9	157.1	31.8	21	Leukocyte, 12,200, polym. 68%

Case 26, 9 yr., female; mitral and aortic insufficiency, mitral stenosis

6/29	31.8	101.6	31.2	38	Almost moribund; liver tremendously enlarged; red cell count, 3 m.; hb., 52%; leukocyte count 15,400, polym. 78%
7/10	51.5	197.5	26.0	10	Liver almost at costal margin; almost complete loss of anasarca, under profuse diuresis
7/17	42.8	148.7	29.0	73	Leukocyte count, 13,300, polym. 69%
8/ 1	39.3	133.9	29.9	52	
6/18	44.4	157.9	27.9	15	Red cell count, 3.95 m.; hb., 70%
7/ 6	43.6	165.6	26.3	39	Leukocyte count, 11,200, polym. 57%

Case 27, 9 yr., male; mitral insufficiency and stenosis

6/29	41.3	154.7	26.7	82	Red cell count, 4.08 m.; hb., 65%; leukocyte count, 15,000, polym. 63%
7/10	39.9	149.2	26.6	89	Temp., 103.8 F.; pulse, 156; liver down to umbilicus
7/18	47.0	172.2	27.2	78	
8/ 1	46.6	170.0	27.4	75	Leukocyte count, 12,200, polym. 63%
8/ 9	44.7	190.6	23.8	45	Leukocyte count, 10,800, polym. 60%; temp., 100.6 F.; pulse, 100

Case 28, 12 yr., female; mitral insufficiency; failure of right and left sides of heart

7/10	43.9	188.8	23.2	78	Temp., 101 F.; leukocyte count, 11,400, polym. 66%
7/18	28.5	107.7	26.9	77	Temp., 104.2 F.; leukocyte count, 13,000, polym. 73%; red cell count, 3.8 m.; hb., 72%

Case 29, 7 yr., female; mitral insufficiency and stenosis; interesting case; patient gradually went downhill over two year period, with markedly congested liver at end; the e.s.r. here shows the false reading often obtained when marked congestive failure is associated with still greater rheumatic activity

7/24	50.8	201.9	25.1	11	Red cell count, 4.6 m.; hb., 78%
7/31	54.0	202.1	26.7	14	Leukocyte count, 9,800, polym. 59%
6/18	49.5	192.0	25.7	60	Liver 1 fingerbreadth below costal margin; temp., 100.2 F.
6/25	52.1	188.9	27.3	17	Liver gradually more decomp.
7/15	52.8	199.8	26.4	15	Temp., 102.4 F.; leukocyte count, 13,800, polym. 71%
7/22	48.4	183.6	26.5	5	Temp., 103.4 F.
7/29	53.2	181.8	29.1	5	Leukocyte count, 16,200, polym. 75%
8/12	54.2	162.7	33.3	4	Temp., 104.2 F.

Case 30, 12 yr., female; mitral insufficiency and stenosis

7/15	55.4	183.6	30.1	75	Liver 1 fingerbreadth below costal margin
7/22	47.0	168.6	27.9	47	
7/29	47.8	156.5	29.2	45	
8/ 5	50.5	187.5	25.9	27	
8/15	41.4	179.4	23.1	15	

Case 31, 10 yr., female; mitral insufficiency and stenosis

8/ 5	51.8	194.1	26.7	23	Red cell count, 4.3 m.; hb., 82%; leukocyte count, 8,200, polym. 60%
8/12	52.3	202.8	25.7	25	

Case 32, 9 yr., male; mitral insufficiency; duration of disease in hospital, 2 wk.

6/13	67.8	201.7	33.4	92	Liver 3 fingerbreadths below costal margin; red cell count, 4.24 m.; hb., 78%; leukocyte count, 14,000, polym. 65%

There are presented now a group of cases (7) which differ from all those previously given by the existence of a definitely positive Mantoux reaction. With the one exception noted, roentgen examination of these patients revealed no evidence of active tuberculosis. The trend of results here resembles somewhat that in cases in which the livers are congested, as the cholesterol levels do not seem to fluctuate as widely with changes in the status of the disease as do those in the previously presented groups.

Case 33, 12 yr., male; mitral insufficiency and stenosis; Mantoux reactions 7 by 5 mm. (+++)

Date	Free C.	Total C.	% Free C.	E. S. R.	
6/13	56.3	192.6	29.2	60	Temp., 103 F.; leukocyte count, 13,700, polym. 75%
7/ 6	58.5	223.5	26.2	35	Temp., 100.2; leukocyte count, 9,300, polym. 62%
7/18	48.2	163.6	29.3	73	Temp., 102.2 F.; auric fibrillation
8/ 1	48.4	192.2	25.6	52	
8/ 9	53.3	198.2	26.9	46	

Case 34, 10 yr., female; mitral insufficiency; Mantoux reaction, 12 by 15 mm.

6/18	40.0	164.8	24.3	26	Red cell count, 4.65 m.; hb., 85%; leukocyte count, 10,600, polym. 72%
7/15	46.2	181.7	25.4	22	
7/23	45.5	178.2	24.7	15	
7/30	42.0	171.0	24.1	12	
8/ 7	45.8	176.2	26.0	8	

Case 35, 11 yr., male; mitral insufficiency and stenosis; Mantoux reaction, 30 by 70 mm.

7/17	46.9	179.5	26.1	40	Red cell count, 4.2 m.; hb., 86%; leukocyte count, 8,400, polym. 61%
7/24	44.9	178.1	25.2	28	
7/31	47.7	190.9	25.0	21	

Case 36, 9 yr., male; Mantoux reaction, 30 by 50 mm.; mitral insufficiency

6/29	57.8	200.5	28.8	49	Red cell count, 3.96 m.; hb., 68%
7/24	54.4	186.6	29.1	67	Leukocyte count, 12,800, polym. 77%
8/15	58.7	203.9	28.7	21	

Case 37, 11 yr., female; mitral and aortic insufficiency, mitral stenosis; Mantoux reaction, 10 by 15 mm.

6/29	43.9	152.4	28.8	27	Leukocyte count, 14,000, polym. 72%
7/ 9	41.6	154.2	26.9	33	
7/16	44.9	181.0	24.8	16	Leukocyte count, 9,700, polym. 64%
7/24	50.7	183.5	27.6	10	
7/31	50.4	178.1	28.3	16	

(Tonsillectomy and adenoidectomy performed 7/19)

Case 38, 7 yr., female; Mantoux reaction, 32 by 20 mm.

7/10	52.8	208.7	25.3	9	Red cell count, 3.6 m.; hb., 62%; leukocyte count, 5,900, polym. 58%
7/24	50.1	200.9	24.3	8	
7/31	52.0	181.5	28.7	26	Leukocyte count, 11,300, polym. 70%

Case 39, 8 yr., female; mitral insufficiency; Mantoux reaction, 22 by 18 mm.; this child was seriously sick, the heart being markedly decompensated on admission, but she improved rapidly under therapy

7/24	39.3	129.5	30.3	40	Leukocyte count, 18,600, polym. 83%
8/14	49.3	226.8	21.3	14	Leukocyte count, 10,700, polym. 61%; liver edge at costal margin

Finally there are offered 5 cases in which the total cholesterol levels were far above the median value and were often out of keeping with the rheumatic activity, as noted by clinical examination and laboratory data. No aberrant factors with regard to organic changes could be

found. Certain psychiatric-functional manifestations which may set these children apart will be discussed in the comment.

Case 40, 9 yr., male; 20 lb. (9.1 Kg.) overweight; no changes seen in electrocardiogram

Date	Free C.	Total C.	% Free C.	E. S. R.	
6/18	49.3	189.4	26.2	24	Red cell count, 4.6 m.; hb., 88%
6/26	62.4	201.0	31.0	40	Leukocyte count, 12,800, polym. 71%; temp., 101 F.
7/15	66.0	205.6	32.1	37	
7/28	51.5	199.2	25.8	10	Leukocyte count, 8,100, polym. 60%; temp., 100.2 F.

Case 41, 8 yr., male; mitral insufficiency; sexually precocious

6/18	72.5	250.0	31.0	16	Red cell count, 4.81 m.
7/ 2	76.1	267.6	28.8	9	

Case 42, 12 yr., female; mitral insufficiency and stenosis; acute otitis media and mastoiditis 7/24; markedly overdeveloped

7/16	57.1	242.4	23.6	55	Red cell count, 3.73 m.; hb., 70%
7/24	58.5	221.1	26.9	60	Leukocyte count, 21,000, polym. 90%
8/ 2	62.2	230.5	27.8	66	Leukocyte count, 15,300, polym. 73%

Case 43, 7 yr., female

7/16	63.2	217.6	29.0		
7/26	52.9	236.5	22.4		

Case 44, 10 yr., male

6/13	55.2	204.3	27.0	17	Red cell count, 4.73 m.; hb., 90%
6/27	53.0	211.9	25.1	21	Leukocyte count, 6,800, polym. 55%

For the sake of completeness, the results in 3 cases that cannot be fitted into any of the previous subgroupings are given. There were neither organic nor functional changes that would indicate separate classification.

Case 45, 10 yr., male; mitral insufficiency

Date	Free C.	Total C.	% Free C.	E. S. R.	
7/ 3	49.3	184.7	26.7	18	Red cell count, 4.08 m.; hb., 64%; leukocyte count, 9,080, polym. 60%
7/17	51.7	211.9	24.8	16	
7/24	45.4	195.8	22.7	12	
7/31	43.6	173.1	25.6	9	

Case 46, 10 yr., female; chorea, mitral insufficiency

6/26	36.5	171.4	21.3	9	Red cell count, 4.36 m.; hb., 70%; leukocyte count, 5,200
7/ 3	56.0	198.6	28.2	4	

Case 47, 12 yr., male

7/18	41.5	129.1	32.2	57	Leukocyte count, 11,800, polym. 74%
7/23	41.1	161.0	25.5	16	
7/31	54.5	172.8	31.5	53	Leukocyte count, 12,900, polym. 68%

COMMENT

The findings must now be fitted into the physiology of cholesterol as conceived at this time. In retrospect, it is seen that a disease so tenacious yet so subject to acute reactivation as rheumatic fever will cause a loss of both free and ester cholesterol to the blood stream, the fall in ester being much the more marked of the two. The acute rheumatic flare-up, characterized by leukocytosis, elevated pulse rate and temperature and an elevated erythrocyte sedimentation rate, is, par excellence, the factor which will cause this fall in the level of serum cholesterol. But from what levels do these diminutions proceed? Sperry,[25] studying a series

25. Sperry, W. M.: Concentration of Total Cholesterol in the Blood Serum, J. Biol. Chem. **117**:391 (Jan.) 1937.

of normal medical students and teachers, found that their serum cholesterol values before and after fasting fluctuated over a range of 250 mg. per hundred cubic centimeters, although ordinary diet did not appear to influence greatly the levels in any given subjects. Offenkrantz and Feraru [26] corroborated this wide person to person fluctuation and the general lack of dietary influence or individual findings. Of greater significance, as was pointed out, by Karshan and me in an earlier paper [1] and since then by Sperry,[27] is the marked stability of the percentage of free cholesterol, whatever the total value. We must postulate, therefore, a physiologic blood cholesterol level for each person, from which he deviates in disease and to which he adheres under conditions of well-being. In an acute condition, such as occurs during the activity of rheumatic fever, there will be a fall in the serum cholesterol level from the norm for that patient. But because there is no uniformity of normal levels among different patients, the amount of change in the blood cholesterol level in one patient cannot be used as a gage for the activity of a disease in another patient. This explains why there cannot be a quantitative correlation between the sedimentation rate and the changes in the blood cholesterol level. The relation between them can only be quantitative, since the levels normally vary so widely from patient to patient. Of equal importance with this fall in the level of the ester fraction is the resulting rise in the percentage of free cholesterol. It should be understood that both the free and the esterified fraction are diminished; yet, since in the activity of a disease without complications there is a concomitant rise in the percentage of free cholesterol, the ester portion must have been more severely diminished. Even in this, however, can be seen the unique stability of the relation between the free and the ester fraction, since in only three determinations was over 35 per cent of the total cholesterol to be found in the free form. For this reason, even a small change in the percentage of free cholesterol may have significance beyond that of a large fluctuation in the total cholesterol level.

In each of the subgroups are certain variations from the basic principle just outlined. The most striking figures are those obtained in patients at or near death. The fall in the level of serum cholesterol was below that in any of the patients who continued to live. With this severe drop in the total cholesterol level, the percentage of free cholesterol rose above 30 in each instance. That this is most likely a progressive decline rather than a terminal phenomenon of the blood stream is shown remarkably well by the case of the young girl who was

26. Offenkrantz, F. M., and Feraru, F.: Study of Serum Cholesterol in Patients with Peptic Ulcer, J. Lab. & Clin. Med. **22**:780 (May) 1937.

27. Sperry, W. M.: Relationship Between Total and Free Cholesterol in Human Blood Serum, J. Biol. Chem. **114**:125 (May) 1936; footnote 25.

followed for weeks before her demise, in whom there were gradually declining total values and a gradually increasing percentage of free cholesterol within those total values. I believe that this represents a gradual breakdown of the processes involved in the defense reaction of the organism against an overwhelming disease. Reasoning from data at hand, one sees that a decreased ester fraction with a rising proportion of free cholesterol is compatible with two hypotheses. The first of these assumes that the blood is an organ capable of greater or lesser physiologic activity and that alterations in the cholesterol level are an indication of intense work on behalf of the body (work of Boyd and of Bloor, Okey and Corner, just described). The other explanation considers the blood as a distributing agent, and the levels of its constituents as indicating only the difference between amounts received into the blood stream from various depots and amounts removed from it at other points, either for use or for excretion. According to the latter theory, diminution of the ester fraction could be due either to a failure of cellular breakdown or to an increase of metabolic need on the part of tissues which derive cholesterol from the blood. Though the conclusion is not subject to immediate experimental confirmation, I believe and feel supported in this after careful analysis of the literature, that the lowered serum cholesterol level associated with states of disease, as portrayed here, represents an uncompensated depletion of this material from the blood. The diversion takes place to certain tissues which are actively engaged in furthering the organism's defense against the disease. In all probability, these tissues will be found in the endocrine glands, in the finite reticuloendothelial system or in both.

The figures of the second subgroup bear out the findings for the first; i. e., activity of rheumatic disease is associated with a fall in the level of the serum cholesterol ester and a rise in the percentage of free cholesterol. In this series, when there were no complicating factors, such as cardiac failure or evidence of tuberculous infection, it was ascertained that no correlation existed between the cholesterol levels and the various degrees of secondary anemia which are almost always a part of the rheumatic state. Findings for the third subgroup confirmed the previously cited findings, since the fall in the total cholesterol level associated with the rise in the percentage of free cholesterol took place during periods of acute activity of the disease, the level returning to normal when the flare-up subsided. "Normal" here is used in the previously explained sense of the ordinary value for a patient. In this group, of which each patient had at least one flare-up during the period of hospitalization, it was noted that during the flare-up there was a general inverse relation between the sedimentation rate and the amount of change in the cholesterol level, but no quantitative observations could be made.

Next to be reviewed are the cases in which at one time or another during the period of observation the patient had marked inefficiency of the liver, due to the chronic passive congestion of that organ which accompanied complete cardiac decompensation. When a condition of acute rheumatic activity (leucokytosis, elevation of pulse rate and temperature, etc.) was superimposed on this decompensation, the usual rise in the percentage of free cholesterol that accompanied the fall in the total value failed to occur in many instances. Apparently the free and esterified fractions fell simultaneously. This confirms the *Estersturz* so widely described for the blood cholesterol in cases of damage to the liver, but it also shows an added factor of regulation of free cholesterol, the meaning of which is not clear. An apparently similar group of findings (less fluctuation of the percentage of free cholesterol and of the total cholesterol generally) was found for those patients with rheumatic fever who exhibited positive Mantoux reactions. That the tuberculosis in this group was not active, except in 1 instance, was shown by the negative results of roentgen and clinical examination.

Finally, there are the 5 patients who were set apart from the others by virtue of a high total serum cholesterol level maintained throughout the period of observation. No organic factors could be discovered to account for the fact that this hypercholesteremic trend continued in the face of acute disease. Intensive study of these children revealed certain structural-functional alinements which are most illuminating. All 5 were somewhat overweight, and 3 of them were definitely larger than comparable children. Through the course of the disease they were exceptionally good natured about the various treatments and diagnostic procedures, some of which entailed discomfort. As to pattern of mental tendencies, their behavior seemed extrovertive; these patients did favors for the other children and were agreeable to the nurses. Because of these tendencies, my co-workers and I are postulating a differential for cholesterol levels on the basis of psychiatric-functional grouping. This point will not be enlarged on here, since I [28] shall shortly release a study of ostensibly normal children and adults whose division into the asthenic-introvertive-anxious or the asthenic-extrovertive-placid type seems to show that the former have a lower serum cholesterol level than the latter.

SUMMARY

A complete series of 100 patients with rheumatic fever has been reported on. Forty-nine of these were taken as a control group, since they had no evidence of rheumatic activity. Evidence of such activity consisted of elevation of the leukocyte count above 10,000 per cubic

28. Offenkrantz, F. M.: To be published.

millimeter; an erythrocyte sedimentation rate above 12 mm. per minute, and inceasing cardiac damage, as shown by electrocardiographic study. The mean total value of the serum cholesterol (and standard deviation) was 181.9 ± 23.5 mg. per hundred cubic centimeters; the mean value of the free serum cholesterol was 50.5 ± 7.4 mg.; the mean percentage of free cholesterol was 27.3 ± 2.23.

Of the remaining 51 patients, 5 died. Analyses of serum cholesterol within one day prior to or ten minutes after death revealed severe depletion of the cholesterol ester and only slight lowering of the free cholesterol level, so that the percentage of free cholesterol rose above 30 in each instance.

Eleven case histories were presented of children who seemed to suffer activity of the rheumatic fever throughout the period of observation. There was no cardiac failure of the right or left side, and all patients had negative Schick and Mantoux reactions. Here likewise the total cholesterol levels of the serum seemed to be definitely lowered and the percentage of free cholesterol elevated, so that the depletion was ascribed to the ester fraction.

In the next series (12 cases), the status of the disease fluctuated, periods of rheumatic inactivity being interrupted by flare-ups. The periods of activity again showed the lowered serum cholesterol level with the elevated percentage of free cholesterol (loss of ester). A general inverse relation was noted between the severity of the ester depletion (with a rise in the percentage of free cholesterol) and the sedimentation time, but this relation was not quantitative.

In 9 patients periods of cardiac decompensation were associated with the rheumatic infection. During such periods of failure, with passive congestion of the liver, the flare-up failed to produce the usual rise in the percentage of free cholesterol, although there was a moderate fall in the total cholesterol values. This indicated that both the ester and the free cholesterol content were lowered. A similar situation seemed to prevail in the 7 cases in which a fluctuating status of disease was complicated by a positive Mantoux reaction, though in 6 of these cases there was no clinical or roentgen evidence of active tuberculosis. Lastly, 5 cases were cited in which unusually high values for total cholesterol prevailed, despite activity of the disease. It was suggested at this point that possibly a psychiatric-functional status is associated with a particular type of cholesterol level in the blood.

The pertinent literature for this study has been cited, and the salient findings have been discussed.

Drs. M. Karshan, R. Schoenheimer and W. Sperry of the Department of Biological Chemistry, College of Physicians and Surgeons, Columbia University, New York, assisted in this study.

RESPIRATORY METABOLISM IN INFANCY AND IN CHILDHOOD

XXI. DAILY WATER EXCHANGE OF NORMAL INFANTS

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The importance of water in the preservation of health and in the treatment of disease in infancy and in childhood has been recognized for many years. The infantile organism is especially hydrolabile, probably because of its high content of body water; this content comprises over 70 per cent in the newly born infant, as against less than 60 per cent in the adult. This hydrolabile tendency is exemplified by the wide fluctuations in daily body weight of healthy infants while on constant diets, by the ready development of dehydration fever in newly born and in older infants temporarily deprived of water and by the occurrence of anhydremia as a frequent accompaniment of infantile diarrhea.

Despite the importance of water to infants, knowledge of their fluid requirements has in large measure been deduced from measurements of the average amounts of milk voluntarily withdrawn from the breast by nursing infants. These observations were later supplemented by studies of water balance, which for the most part were incomplete, since all sources of incoming and outgoing water were not directly determined. The validity of the assumption that the value for fluid intake obtained in these incomplete studies represents the optimal fluid intake for all normal infants can be assessed more accurately through continuous and complete studies of the water exchange throughout the twenty-four hours under varying conditions of diet and environment.

This paper presents the results of 28 such measurements of the water exchange of 16 healthy infants. Seven observations on 3 of the infants were made in conjunction with previously reported twenty-

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The early observations were made in collaboration with Dr. J. R. Wilson and Dr. T. C. Wyatt.

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four hour measurements of their energy and organic (protein, fat and carbohydrate) exchanges.[1]

APPARATUS AND METHODS

A detailed description of the methods employed for analysis of the diet and excreta (urine and feces), for measurement of the twenty-four hour insensible loss from skin and lungs, for determination of the daily respiratory exchange and for calculation of the composition of the metabolic mixture was given in previous papers.[2]

In a study of the exchange of water between the body and the environment, all sources of incoming and outgoing water must be known.[3] The incoming water comprises (1) the water ingested as such, (2) the preformed water of the so-called solid foods and (3) the water of combustion derived from the oxidation of organic foodstuffs within the body.[4] A fourth item, tissue water, sometimes included in the available sources, is the fraction held in physical combination with body protein, fat and glycogen. Since this moiety is already present in the body as water, shifts in it will be reflected solely in alterations of extracellular and intracellular fluid and will not affect the net water exchange between the body and the environment.

Outgoing water comprises the quotas eliminated through (1) urine, (2) feces and (3) skin and lungs.[5] The difference between incoming

1. Levine, S. Z.; McEachern, T. H.; Wheatley, M. A.; Marples, E., and Kelly, M. D.: Respiratory Metabolism in Infancy and in Childhood: XV. Daily Energy Requirements of Normal Infants, Am. J. Dis. Child. **50**:596 (Sept.) 1935.

2. Levine, S. Z., and Wheatley, M. A.: Respiratory Metabolism in Infancy and in Childhood: XVII. Daily Heat Production of Infants; Predictions Based on the Insensible Loss of Weight Compared with Direct Measurements, Am. J. Dis. Child. **51**:1300 (June) 1936. Levine and others.[1]

3. Newburgh, L. H.; Johnston, M. W., and Falcon-Lesses, M.: Measurement of Total Water Exchange, J. Clin. Investigation **8**:161 (Feb.) 1930. Wiley, F. H., and Newburgh, L. H.: Improved Method for the Determination of Water Balance, ibid. **10**:723 (Oct.) 1931.

4. The constants of Newburgh[3] were used to calculate the water of oxidation. One gram of protein, of fat and of carbohydrate when oxidized in the body releases as end products 0.41, 1.07 and 0.60 Gm. of water, respectively. The composition of the metabolic mixture of 3 infants (H. S., J. F. and J. C.) was determined directly in the respiration chamber on the final day of each of 7 observations (17 through 23). In the remaining observations, the daily metabolic mixture was calculated from the energy exchange measured for periods of from two to four hours, the dietary carbohydrate, the urinary nitrogen and the daily behavior records of the infants.[1]

5. The water loss through skin and lungs was determined from the total insensible perspiration by deducting the difference between exhaled carbon dioxide and inhaled oxygen. $CO_2 - O_2$ was considered to equal $0.41\ C + 0.08\ P - 0.08\ F$, when C, P and F represent the grams of carbohydrate, protein and fat, respectively, in the metabolic mixture.[3]

and outgoing water provides a direct measure of the water balance during the period of observation (table 1).

The technic of measurements was essentially as follows:

At the start of the observation and at the same time on succeeding days until the end of the period, the infant, the daily intake and the daily output in urine and feces were weighed on a specially constructed balance with a capacity of 10 Kg. and an accuracy of 50 milligrams.[6] Between daily weighings, the infants reclined on a metabolism bed, which, with competent nursing, insured quantitative collections of urine and feces over prolonged periods. The bed and the collecting apparatus, both of which were designed by Dr. Hoag, were fully described by him in a previous communication.[7] The difference between the initial weight of the baby plus the weight of the intake on the one hand and the final body weight plus the weight of the urine and feces on the other afforded an accurate measure of the daily loss through skin and lungs, provided other losses, such as loss through vomiting, did not occur during the period.

TABLE 1.—*Items in a Water Balance Sheet*

Direct Measurement (Modified after Newburgh [3])

Sources of available water	Outgoing water
1. Intake as such	1. In urine
2. In solid foods	2. In feces
3. Of oxidation:	3. In insensible perspiration:
Protein × 0.41	Insensible perspiration — ($CO_2 - O_2$)
Fat × 1.07	($CO_2 - O_2$) = (P × 0.08) — (F × 0.08) +
Carbohydrate × 0.60	(C × 0.41)

Indirect Measurement

Total change in body weight minus change in weight due to:
1. Protein intake — (feces + metabolized)
2. Fat intake — (feces + metabolized)
3. Carbohydrate intake — (metabolized)

} = water balance

This method of weighing afforded quantitative data on the total intake, on the total outgo and on changes in body weight during the observation. The individual increments of outgo through urine, feces and skin and lungs were also available, and a complete weight balance of the infant could be tabulated. By analysis of the intake and the excreta (urine and feces) for their water content and by determination of the composition of the metabolic mixture either through direct measurement of the respiratory exchange or through calculation,[8] a water balance was concurrently obtained.[9]

6. Levine, S. Z.; Wilson, J. R., and Kelly, M. D.: Insensible Perspiration in Infancy and in Childhood: I. Its Constancy in Infants Under Standard Conditions and the Effect of Various Physiologic Factors, Am. J. Dis. Child. **37**:791 (April) 1929.

7. Hoag, L. A.: Apparatus for the Quantitative Collection of Urine and of Stools in Male Infants, Am. J. Dis. Child. **44**:770 (Oct.) 1932.

8. Footnotes 4 and 5.

9. The following methods were employed in triplicate for analysis of the diet and, when indicated, of the urine and feces: the macro-Kjeldahl method for

(Footnote continued on next page)

Concurrent measurements of the total change in body weight with the balance and of the water balance, obtained by chemical analysis of the diet and the excreta (urine and feces) in conjunction with measurements of the twenty-four hour energy metabolism in the respiration chamber on the final days of 7 observations (17 through 23), afforded a means of checking the reliability of the direct method of measurement of the daily water exchange (table 1). The comparative results are shown in table 2.

The similarity of the average figures for the twenty-four hour change in body weight secured in toto with the balance (64 Gm.) and by algebraic summation (50 Gm.) of the individual components (protein, fat, carbohydrate and water) attests to the reliability of the water balances reported in this paper.[10] When one recalls the magnitude of

TABLE 2.—*Comparison of the Organic Balance plus the Water Balance with the Actual Change in Body Weight (in Grams per Twenty-Four Hours)*

			Balance*						
			Organic					Actual Change in Weight‡	Difference (6 — 5)
Subject	Observation No.	Date	P (1)	F (2)	C (3)	Water (4)	Total† (1+2+3+4) (5)	(6)	(7)
H. S.	17a	11/16/31	5.8	17.0	—0.9	82	104	117	13
J. F.	18a	1/ 8/32	4.6	14.5	—4.5	40	55	80	25
J. C.	19a	2/19/32	5.4	17.4	—2.1	14	35	46	11
J. C.	20a	2/26/32	—1.9	—9.1	0.2	—3	—14	—5	9
J. C.	21a	3/ 4/32	4.3	25.9	—1.1	39	68	83	15
J. C.	22a	4/15/32	4.6	9.0	1.4	2	17	25	8
J. C.	23a	4/21/32	0.3	10.2	—1.7	79	88	103	15
Average							50	64	14

* Balance is positive except where indicated.

† Balances of organic materials and of water were determined by measurement of the respiratory exchange for from twenty and one-half to twenty-three hours and chemical analysis of urine, feces and diet.[1]

‡ Actual change in body weight was determined by weighing the infant just before and after observation in the respiration chamber.

the items involved in the balances (approximating 1,000 Gm. each in the intake and output for these observations) and the diverse technics employed in obtaining the two series of measurements, one is impressed

nitrogen; the Roese-Gottlieb method (Association of Official Agricultural Chemists: Official and Tentative Methods of Analysis Compiled by the Committee on Editing Methods of Analysis, Washington, D. C., Association of Official Agricultural Chemists, 1930, p. 217) for fat; the official gravimetric method of the Association of Agricultural Chemists (id., p. 216) for lactose, and prolonged drying to constant weight for water. The dietary calories were determined by multiplying the grams of protein (N × 6.25), fat and carbohydrate, as analyzed, by the customary constants, 4.1, 9.3 and 4.1, respectively.

10. Balance studies of a number of inorganic substances (sodium, potassium, chlorine, calcium and phosphorus) were made concurrently on a number of infants, but the amounts of these substances are so trivial on the basis of weight that they may for practical purposes be disregarded in estimating the materials involved in total changes of body weight.

by the narrow range of deviations shown in the table. Differences between actual and calculated values for change in body weight ranged between 8 and 25 Gm. daily in individual observations and averaged 14 Gm. for the entire series. Unless one assumes that the various sources of error fortuitously arranged themselves to compensate for each other, the results may be accepted as a check on the accuracy of the chemical and metabolic operations and the methods of calculation.

EXPERIMENTAL PROCEDURE

Studies of the water exchange of 16 male infants ranging in age from 3 to 11½ months were made in 28 observations of from one to seven days' duration for a total of eighty-five days. The age and nutritional status of the infants are shown in table 3. They were all in good health during the periods of study.

Observations were begun after foreperiods of constant diet of at least two and usually more days. The diets consisted of mixtures of cow's milk, cane sugar or dextrimaltose and water; thoroughly mixed, pooled samples of dried milk preparations were almost invariably used. The composition of the diets is shown in table 3.

Fourteen infants resided in a metabolism ward, described in previous papers.[11] The environmental conditions were maintained as constant as possible without the aid of an air-conditioned room, and the water balances of the infants while on adequate diets and under varying conditions of diet (both fluid and caloric intake) were studied. The effect of environmental temperature and humidity on water exchange was determined in 2 infants (I. R. and F. L.), who were studied in an air-conditioned room which permitted rigid control of external conditions. In the series of observations on the effect of diet and environmental conditions on water balance, the same infant was used throughout successive periods and all variables except the one under investigation were maintained constant.

RESULTS

Detailed data of the observations are presented in table 4.

The Water Exchange of Healthy Infants on Adequate Diets.—In order to establish the magnitude and range of the water balances of normal infants receiving formulas customarily employed in infant feeding, 14 healthy infants were studied in 17 observations of from two

11. Levine, S. Z., and Wilson, J. R.: Respiratory Metabolism in Infancy and in Childhood: I. Basal Metabolism of Children, Am. J. Dis. Child. **31**:323 (March) 1926. Wilson, J. R.; Levine, S. Z., and Rivkin, H.: Respiratory Metabolism in Infancy and in Childhood: II. Ketosis and the Respiratory Exchange in Children, ibid. **31**:335 (March) 1926.

TABLE 3.—*Nutritional Status, Daily Diet and Rectal Temperature of Subjects*

Subject	Date	Observation No.	Period, Days	Nutritional Status			Daily Diet					Average Rectal Temperature, F.	Environmental Conditions	
				Age, Mo.	Weight, Kg.	Height, Cm.	Calories	Protein, Gm.	Fat, Gm.	Carbohydrate, Gm.	Fluid,* Gm.		Average Temperature, C.	Average Humidity, Percentage
W. B.	2/ 6/28	1	5	8½	6,748	70.5	844	27	33	104	956	99.0	25	30
	2/11/28	2	6	8½	6,895	71.0	844	27	33	104	1,3.6	98.5	24	35
J. N.	2/23/28	3	7	11½	6,281	....	861	40	48	61	1,215	98.5	25	22
K. F.	4/25/28	4	3	5½	6,119	....	834	34	39	81	976	98.4	24	25
E. B.	5/18/28	5	4	10	7,725	....	825	35	42	71	1,018	99.0	25	50
J. H.	12/14/28	6	3	7	6,520	....	861	40	48	61	1,029	98.8	25	39
W. A.	11/18/29	7	2	5½	7,545	70.0	810	30	35	88	1,042	98.5	25	40
K. B.	12/15/29	8	2	8	7,742	....	810	30	35	88	1,079	99.0	25	41
K. M.	1/ 2/30	9	2	8½	7,256	71.0	700	30	30	73	962	98.7	26	40
J. S.	1/ 8/30	10	2	8	7,475	....	700	30	30	73	994	98.0	..	..
W. D.	3/24/30	11	2	9	5,225	69.0	376	26	18	25	1,037	98.9	..	..
	3/26/30	12	3	9	5,173	69.0	311	22	14	22	1,597	98.4	..	..
W. L.	5/ 5/30	13	1	5	4,427	64.0	275	18	16	13	1,381	98.0	29	28
	5/ 6/30	14	1	5	4,453	64 0	272	18	16	13	1,683	98.1	..	..
	5/ 7/30	15	1	5	4,508	64.0	397	26	23	19	1,701	98.0	..	..
	5/ 8/30	16	1	5	4,533	64.0	414	27	24	20	2,035	97.8	..	..
H. S.	10/12/31	17	4	6½	6,978	67.0	807	34	40	72	1,173	99.9	26	40
J. F.	1/ 5/32	18	3	9	7,166	71.0	863	37	42	78	1,132	98.7	24	43
J. C.	2/16/32	19	3	4½	6,283	65.0	682	30	34	59	1,093	98.8	24	28
	2/23/32	20	3	4½	6,100	65.0	341	15	17	30	1,032	98.3	24	25
	3/ 1/32	21	3	5	6,602	65.0	863	37	42	78	1,027	98.9	23	35
	4/12/32	22	3	6½	7,320	68.0	678	30	34	58	1,081	98.6	24	30
	4/19/32	23	2	6½	7,243	68.0	678	30	34	58	619	101.3	24	35
	4/22/32	24	1	6½	7,407	68.0	503	22	25	44	1,275	99.6	24	25
I. R.	2/13/33	25	5	3	3,741	58.5	562	22	23	63	845	98.7	22	60
	2/20/33	26	5	3	4,048	58.5	555	22	23	61	826	98.7	29	60
F. L.	10/ 4/33	27	3	7	6,394	61.5	792	31	34	85	1,041	98.6	22	40
	10/ 9/33	28	5	7	6,656	62.5	792	31	34	85	1,041	98.8	22	80

* The figures recorded in this column represent the total weights of the intake.

TABLE 4.—*Detailed Data on Water Exchange in Terms of Twenty-Four Hours*

Subject	Observation No.	Metabolic Mixture*				Available Water			Outgoing Water				Total Insensible Loss, Gm.	Water Balance, Gm.	Change in Body Weight, Gm.
		Calories	Protein, Gm.	Fat, Gm.	Carbohydrate, Gm.	Intake, Gm.	Oxidation,† Gm.	Total, Gm.	Total, Gm.	Urine, Gm.	Feces, Gm.	Skin and Lungs,‡ Gm.			
W. B.	1	566	25	4	104	822	77	899	876	228	125	523	567	+ 23	+ 20
	2	566	25	4	104	1,232	77	1,309	1,277	513	186	578	622	+ 32	+ 32
J. N.	3	508	22	18	61	1,091	65	1,156	1,138	548	50	540	565	+ 18	+ 21
K. F.	4	511	30	6	81	863	67	930	847	317	48	482	517	+ 83	+ 84
E. B.	5	637	30	24	71	916	81	997	924	182	190	552	582	+ 73	+ 89
J. H.	6	516	24	18	61	925	66	991	955	486	92	377	402	+ 36	+ 45
W. A.	7	630	25	16	92	896	83	979	924	519	42	363	401	+ 55	+ 56
K. B.	8	650	30	16	92	961	85	1,046	982	398	12	572	611	+ 64	+ 48
K. M.	9	628	30	19	80	853	81	934	862	299	37	526	560	+ 72	+ 44
J. S.	10	637	30	20	80	888	82	970	929	333	71	525	559	+ 41	+ 40
W. D.	11	420	23	24	25	959	50	1,009	1,061	571	78	412	422	— 52	— 47
	12	420	23	24	25	1,527	50	1,577	1,606	1,135	66	405	415	— 29	— 26
W. L.	13	352	9	28	13	1,328	41	1,369	1,367	909	68	390	394	+ 2	+ 7
	14	348	9	28	13	1,630	41	1,671	1,637	1,220	31	386	390	+ 34	+ 38
	15	411	16	29	19	1,630	49	1,679	1,611	1,108	50	453	460	+ 68	+ 73
	16	400	14	28	20	1,975	48	2,023	2,041	1,543	57	441	448	— 18	— 24
H. S.	17	570	26	18	72	1,003	73	1,076	1,088	424	117	547	577	— 12	+ 34
J. F.	18	585	28	16	78	960	75	1,035	1,014	455	90	469	502	+ 21	+ 63
J. C.	19	483	22	16	59	957	62	1,019	1,021	590	67	364	389	— 2	+ 36
	20	409	15	24	30	964	50	1,014	1,033	756	21	256	268	— 19	— 20
	21	536	30	10	78	851	70	921	916	401	108	407	441	+ 5	+ 53
	22	521	23	20	59	945	66	1,011	1,007	591	52	364	388	+ 4	+ 34
	23	548	27	21	59	483	69	552	582	-197	45	340	365	— 30	— 5
	24	566	26	30	44	1,172	69	1,241	1,000	319	39	642	660	+241	+240
I. R.	25	364	13	6	62	725	49	774	752	417	69	266	292	+ 22	+ 39
	26	360	13	6	61	707	48	755	744	216	58	470	496	+ 11	+ 41
F. L.	27	522	22	9	85	881	70	951	930	498	61	371	407	+ 21	+ 52
	28	536	23	10	85	881	71	952	941	449	67	425	461	+ 11	+ 47

* The metabolic mixture was determined directly in the respiration chamber throughout the twenty-four hours of the final day of observation 17 through 23. In the remaining observations it was estimated from the dietary carbohydrate, the urinary nitrogen (× 6.25), the respiratory quotient obtained in periods of from two to four hours and the daily activity records of the infants.

† The water of oxidation was determined from the metabolic mixture by use of the constants of Newburgh:[3] $(P \times 0.41) + (F \times 1.07) + (C \times 0.60)$.

‡ The water loss through skin and lungs was determined from the total insensible loss by deducting the fraction contributed by exhaled carbon dioxide less inhaled oxygen:[3] $CO_2 - O_2 = (C \times 0.41) + (P \times 0.08) - (F \times 0.08)$.

to seven days each for a total of sixty days. The ages of the infants ranged from 3 to 11½ months and the weights from 3.7 to 7.7 Kg. The protein, the caloric and the fluid content of the milk mixtures employed averaged 4.8 Gm., 118 calories and 160 Gm. per kilogram of body weight per twenty-four hours (2.1 Gm., 53 calories and 2.4 ounces per pound) and ranged from 3.9 to 6.4 Gm. of protein, from 94 to 150 calories and from 132 to 225 Gm. per kilogram, respectively. Such diets are generally accepted as adequate to cover the physiologic requirements of infants. The results are summarized in table 5.

Of the average total of 150 Gm. of water available in the intake of these 14 infants, 65, 13 and 68 Gm. per kilogram of body weight were eliminated by way of urine, feces and skin and lungs, respectively, leaving a balance of 4 Gm. per kilogram for retention. In terms of percentages of available water, the partition of outgoing water averaged 43 per cent through the urine, 9 per cent through the feces and 45 per cent through the skin and lungs; 3 per cent of the incoming water was retained within the body. The notable fraction contributed by the skin and lungs to outgoing water emphasizes the importance of this avenue of elimination and the inaccuracy of clinical estimates of water balance based only on intake of fluid and volume of urine.

It should be noted that the cited figures represent averages for total periods and that the distribution of water elimination through the different channels varied not only in individual infants on comparable diets (tables 3 and 4) but even in the same infant on successive days (not shown in tables). These fluctuations in water elimination from day to day are in accord with the clinically recognized hydrolability of infants, and they reaffirm the importance of prolonged observations for valid interpretation of results of studies of water exchange in these subjects. The greater elasticity of the compartment of urinary water (range, from 24 to 111 Gm. per kilogram; coefficient of variability, $\frac{\sigma}{\text{mean}} = 32$ per cent) as compared with the excretion through skin and lungs (range, from 48 to 86 Gm.; coefficient of variability, 19 per cent) will be more fully discussed in a later section.

Although individual infants varied in their elimination of water through the different avenues, an equilibrium or positive water balance was obtained in all except 2 observations (observations 17 and 19). Of particular significance is the correlation of water balance to total change in body weight with these diets. The total gain in body weight of the 14 infants averaged 46.5 Gm. daily, of which water constituted 32.7 Gm., or 70 per cent. The demonstration that the average proportion of retained water to total accretion of body weight coincides with the water content of the infantile body provides, in conjunction with previously reported data,[1] experimental evidence that the relative and the absolute amounts of organic materials and of water deposited in

TABLE 5.—*Water Balance and Partition of Excretion of Healthy Infants on Adequate Diets per Kilogram of Body Weight per Twenty-Four Hours*

Subject	Observation No.	Period, Days	Average Weight, Kg.	Daily Diet			Available Water,† Gm.	Partition of Outgoing Water						Total, Gm.	Water Balance	
				Protein, Gm.	Calories	Fluid,* Gm.		Urinary		Fecal		Skin and Lungs			Gm.	%‡
								Gm.	%‡	Gm.	%‡	Gm.	%‡			
E. B.	5	4	7,725	4.5	107	132	129	24	18	25	19	71	55	120	9	7
K. M.	9	2	7,256	4.1	96	133	129	41	32	5	4	72	56	118	11	8
J. S.	10	2	7,475	4.0	94	133	130	45	34	9	7	70	54	124	6	4
W. A.	7	2	7,545	4.0	107	138	130	69	53	6	4	48	37	123	7	6
K. B.	8	2	7,742	3.9	105	139	135	51	38	2	1	74	55	127	8	6
W. B.	1	5	6,748	4.0	125	142	133	34	25	19	14	78	58	131	2	3
J. C.	22	3	7,320	4.1	93	148	138	81	58	7	5	50	36	138	0	0
	21	3	6,602	5.6	131	156	140	61	44	16	12	62	44	139	1	1
J. F.	18	3	7,166	5.2	120	158	144	63	44	13	9	65	45	141	3	2
J. H.	6	3	6,520	6.1	132	158	152	75	49	14	9	58	38	147	5	4
K. F.	4	3	6,119	5.6	136	160	152	52	34	8	5	79	52	139	13	9
F. L.	27	3	6,394	4.8	124	163	149	78	52	10	6	58	39	146	3	2
H. S.	17	4	6,978	4.9	116	168	154	61	39	17	11	78	51	156	−2	−1
J. C.	19	3	6,283	4.8	109	174	162	94	58	11	7	58	36	163	−1	0
J. N.	3	7	6,281	6.4	137	193	184	87	47	8	4	86	47	181	3	2
W. B.	2	6	6,895	3.9	122	200	190	74	39	27	14	84	44	185	5	2
I. R.	25	5	3,741	5.9	150	225	207	111	54	18	9	71	34	200	7	3
Average.....			6,752	4.8	118	160	150	65	43	13	9	68	45	146	4	3

* Total weight of intake.
† Includes ingested water and water of oxidation.
‡ The figures in these columns represent percentages of available water.

the body by means of the diets customarily employed in infant feeding are both qualitatively and quantitatively compatible with adequate growth.

Effect of Variations of Fluid Intake on the Water Exchange of Infants.—The effect of augmentation of the fluid intake on the water balance is graphically presented in charts 1 and 2. In chart 1 the observations of table 5 have been arranged in three groups, in which the daily fluid intake averaged 136, 157 and 192 Gm. per kilogram of body weight (range: 130 to 145, 146 to 165 and 166 to 225 Gm. per kilogram). No augmentation is noted in the water balance with increasing fluid intake, the water available for retention averaging 7, 4 and 3 Gm. per kilogram, respectively, for the low, moderate, and high normal levels of intake. The fecal and the insensible quota likewise remained relatively constant, but the urinary quota rose from 44 to 68 to 85 Gm. per kilogram of body weight.

The response of the different compartments of outgoing water to enhanced fluid intake was even more strikingly demonstrated in 4 infants (J. C., observations 22 and 23; W. B., observations 1 and 2; W. D., observations 11 and 12; W. L., observations 13 and 14 and observations 15 and 16) whose caloric intake remained constant in each pair of observations (table 3) but whose fluid intake was raised in successive periods from a daily minimum of 85 Gm. (J. C., observation 23) to a daily maximum of 449 Gm. per kilogram of body weight (W. L., observation 16). Here again, enhancement of the fluid intake resulted in notable increases in the urinary output of each infant, with relatively small or negligible alterations in water balance or in the fecal and insensible compartments of water elimination. Practically all of the excess water of the intake in each pair of observations was eliminated in the urine.

The evidence suggests that the compartment of urinary water is the most labile of all avenues of water elimination and that in a state of health and with ordinary conditions of diet and environment, alterations of fluid intake are reflected primarily in this fraction. That additional fluid in the diet did not augment the retention of water within the body lends further experimental support to the practice of feeding healthy infants approximately 150 cc. of fluid per kilogram of body weight (2 to 3 ounces per pound). Routine administration of fluid beyond this level serves merely to dilute the urine.

The water elimination through skin and respiratory passages, on the other hand, was essentially independent of the fluid intake in these observations, suggesting that this avenue of elimination was under the control of a more stable physiologic mechanism than that of water regulation. Data demonstrating that this mechanism is concerned with the

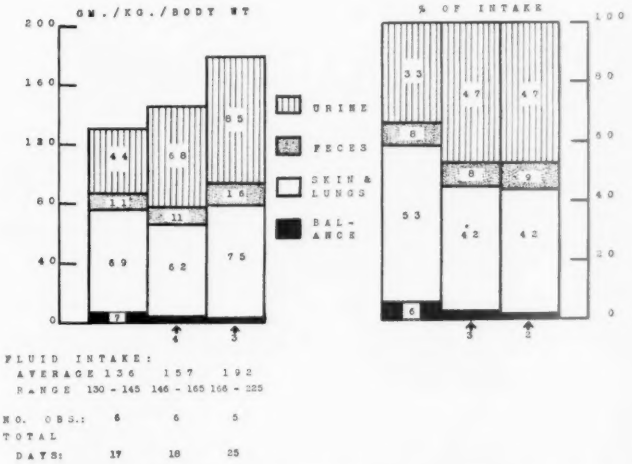

Chart 1.—Water balance of normal infants on adequate diets (arranged according to fluid intake). The total height of the columns indicates the total available water; the vertically lined compartments, the output of water in the urine; the dotted areas, fecal water; the blank areas, loss of water through the skin and the lungs. The difference between incoming and outgoing water is designated by the shaded areas and represents shifts in body water. The same designation is used in the following figures.

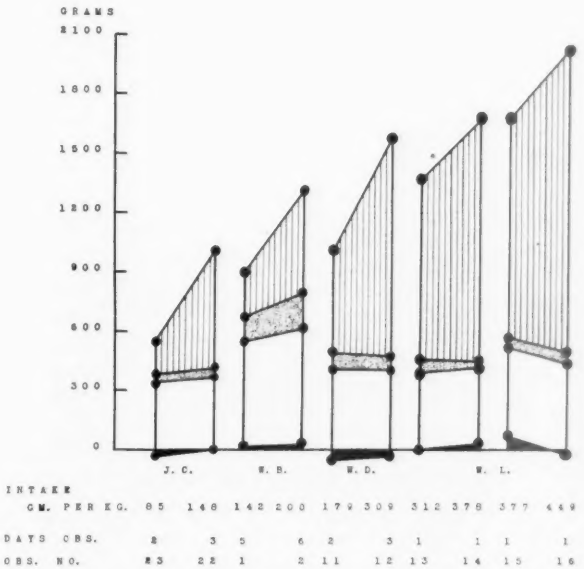

Chart 2.—Effect of increasing fluid intake on water exchange of normal infants. Each vertical line is a single observation.

regulation of body temperature will be presented in the following sections.

The present studies on water exchange with increasing fluid intakes were made with one exception (observation 23) at levels well above the accepted minimal fluid requirements of infants. In one observation, infant J. C., with a daily fluid intake of 85 Gm. per kilogram of body weight, had typical dehydration fever, his rectal temperature reaching 39.3 C. (102.8 F.) on the third day of reduced fluid intake. The pathogenesis of dehydration fever in infants and its relation to water and electrolyte exchange are at present under investigation.

Effect of Variations of Caloric Intake on the Water Exchange of Infants.—A series of 4 observations (19 through 22, table 3), each of

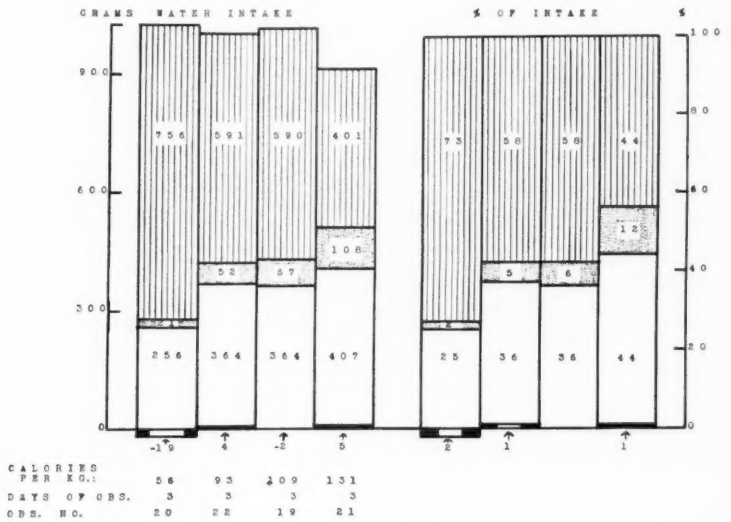

Chart 3.—Effect of alterations in caloric intake on water exchange of a healthy infant (J. C.).

three days, was made on 1 infant (J. C.) to determine the effect on his water exchange of changes in caloric intake when the amount of fluid in the diet was constant. This infant received milk mixtures of the usual qualitative composition and containing constant and adequate amounts of fluid (approximately 150 Gm. per kilogram), but the caloric intake was progressively raised from the low level of 56 to 93, 109 and finally 131 calories per kilogram of body weight. The results are graphically shown in chart 3.

When the diet was adequate both in calories and in fluid (observations 19 and 22), 58 per cent of the water intake was eliminated in the urine, 6 per cent in the feces and 36 per cent in the insensible perspiration. A reduction in the intake from the maintenance levels of 93 and

109 calories to the submaintenance level of 56 calories per kilogram (observation 20) was accompanied by a sharp decline in the fecal and the insensible loss of water and by a striking augmentation of the urinary loss. Conversely, with the hypermaintenance level of 131 calories per kilogram (observation 21), the fecal and the insensible loss increased notably and the urinary water fell to a distinctly lower level.

The parallelism between fecal output and food intake is in accord with expectation. It is generally recognized that the total bulk of the stool and presumably of the fecal water depends on the amount of ingested food. The correlation between insensible loss of water and caloric intake is also readily explained if one recalls the relationship which exists between insensible perspiration and energy metabolism. The low, normal and high caloric diets stimulated the metabolism to different degrees, so that the daily heat production, as actually measured throughout the final day of each experimental period, totaled 395,460,510 and 530 calories, respectively. These increases in energy exchange in turn augmented the insensible perspiration,[13] the insensible water rising from 256 to 364 to 407 Gm. daily. With a constant fluid intake and with no marked change in the water balance in the different periods, this increase in insensible and in fecal loss was necessarily reflected in a corresponding reduction of urinary water (from 756 to 590 to 401 Gm. in twenty-four hours).

These results are consistent with the conception that at levels of fluid intake well above the minimum for adequate urinary secretion, the output of urinary water represents a claim on available water which is subordinated to the need for regulating body temperature by vaporization through the skin and lungs. The clinical counterpart of these observations is seen in the diminution of urinary secretion accompanying the high metabolism of fever, and they point to the necessity for administering extra fluids to febrile infants in order to maintain urinary secretion and flow at a level adequate to remove the end products of the heightened metabolism.

Effects of Variations in Environment on Water Exchange.—The effect of variations in environmental temperature and relative humidity is shown in chart 4.

Elevation of the environmental temperature in 1 infant (I. R., observations 25 and 26) from 22 to 29 C. (from 72 to 84 F.), with the relative humidity constant at 60 per cent, markedly increased the water loss through skin and lungs (from 266 to 470 Gm., or from 34 to 62 per

13. It was shown in a previous paper [2] that under environmental conditions which could not be rigidly controlled this relationship was not sufficiently consistent except under strictly basal conditions to permit prediction of the total daily metabolism of infants from their measured water of vaporization.

cent of the intake), with a corresponding decrease in the urinary water (from 417 to 216 Gm., or from 54 to 29 per cent of the intake). Increase of the relative humidity from 40 to 80 per cent with the temperature maintained constant at 22 C. (72 F.; infant F. L.) resulted in a similar but less striking increase in the water lost through the skin and lungs (from 371 to 425 Gm., or from 39 to 45 per cent of the intake), while the urinary water fell from 498 to 449 Gm., or from 52 to 47 per cent of the total intake. The fecal water remained relatively constant, and in each five day period the daily water balance remained positive (from 11 to 22 Gm. per day).

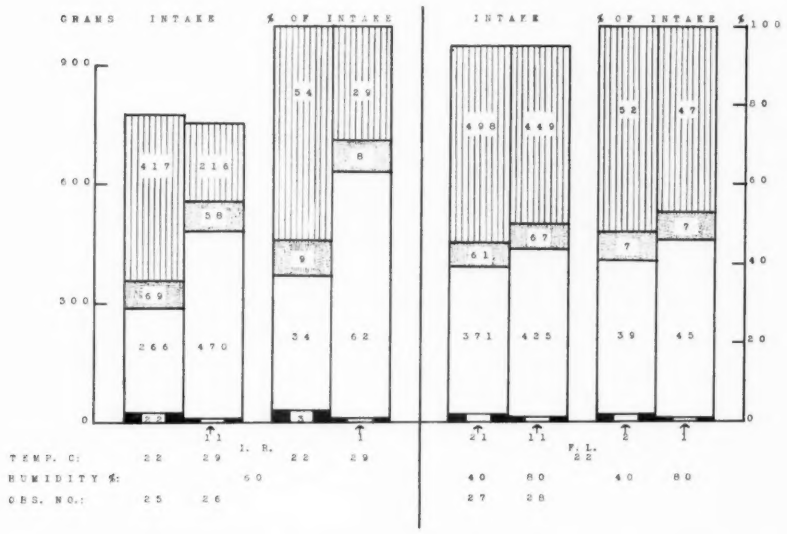

Chart 4.—Effect of alterations in environment (temperature and humidity) on water exchange of normal infants.

These observations supplement the dietary studies in calling attention to the auxiliary role of the kidneys in the excretion of water in health and under usual conditions of diet. The necessity for regulating body temperature by extra vaporization of water from skin and lungs at the high levels of external temperature and humidity represented a prior claim on the supply of available water, with the result that water was shunted from renal to extrarenal channels, leaving adequate surpluses for retention in all periods. Under conditions of more limited fluid intake or more extreme environment, sufficient water might not be available for adequate vaporization from skin and lungs, for urinary flow and for deposition of body water, with resultant development of fever, retention of waste products and dehydration, singly or in combination.

COMMENT

This paper presents a comprehensive system for the metabolic measurement of water exchange in infants modified after the methods elaborated by Newburgh.[3] Direct measurement for from twenty and one-half to twenty-three hours in 7 observations in the respiration chamber of the oxygen consumption, the carbon dioxide production and the water elimination through skin and lungs, combined with chemical analyses of the diet for water, nitrogen, fat and carbohydrate, of the urine for water and nitrogen, and of the feces for water, nitrogen and fat, afforded a means of checking the reliability of the revised methods for calculating water exchange.[14] The close agreement between the daily change in weight measured in toto with the balance and the sum of the organic and the water balance (table 2) substantiates the validity of the technical procedures.

The difficulties inherent in measuring the respiratory exchange of infants have prompted a number of investigators to employ total weight balances as a means of measuring the water exchange. These workers have assumed that the total weight of the intake, including solid constituents, may be substituted for the water intake as such plus the water of oxidation and that, on the outgoing side, the total insensible loss plus the total weight of the excreta may be estimated as water, the fractions ascribable to carbon dioxide less oxygen in the former and to solids in the latter being omitted from consideration.

Justification for the use of this simple method of weighings in the study of the water exchange of infants resides in the fact that water naturally forms a considerable fraction of both the intake and the excreta of infants (87 per cent of milk, 98 per cent of urine, 80 per cent of feces, from 85 to 95 per cent of the insensible loss) and of the total change in body weight (70 per cent of tissues).

In the 17 observations on normal diets reported in this paper, the water balance obtained by direct measurement averaged 33 Gm. daily and the total gain in body weight 47 Gm. (table 5). Although the absolute difference of 14 Gm. is small, the figure for total gain in weight represents a deviation of 43 per cent from the figure for the directly determined water balance. In addition, inconsistencies of the correlation between the two series of measurements were demonstrable in individual infants. These inconsistencies, jointly with the probably greater disparity which would prevail in abnormal states of body hydration, impair the clinical usefulness of the method of simple weighings for determining the water exchange of infants. The conclusion is justified that more precise knowledge than can be derived by use of this method is needed in

14. Lavietes, P. H.: Metabolic Measurement of Water Exchange, J. Clin. Investigation **14**:57 (Jan.) 1935. Peters, J. P.: Body Water: The Exchange of Fluids in Man, Springfield, Ill., Charles C. Thomas, Publisher, 1935.

careful studies of the fate of water in the body not only in health but especially in the hydrolabile states accompanying disease. Studies designed to correlate shifts in body water with electrolyte change will be presented in a future publication, which will serve as further substantiation of the reliability of the methods used in the metabolic measurement of water exchange.

SUMMARY

Metabolic measurements of the water exchange were made in 28 observations of from one to seven days each on 16 healthy, full term male infants from 3 to 11½ months of age.

Twenty-four hourly determinations of the energy exchange in the respiration chamber, chemical analyses of the diet and excreta (urine and feces) and concurrent measurements of body weight served to control the validity of the methods employed for calculation of the water exchange. The magnitude of the disparity between the water balance and the weight balance was briefly discussed.

With normal diets (118 calories, 4.8 Gm. of protein, 160 Gm. of fluid per kilogram in twenty-four hours) and ordinary conditions of environment, 65, 13 and 68 Gm. of water per kilogram of body weight were eliminated through urine, feces and skin and lungs, respectively. Urinary water averaged 43 per cent, fecal water 9 per cent and extrarenal water (skin and lungs) 45 per cent of the total available water, leaving a surplus of 3 per cent for retention within the body.

The water retained within the body by subjects receiving the normal diets averaged 33 Gm., which is compatible with the building up of 47 Gm. of new tissue daily. (Water content of infantile tissue equals 70 per cent.)

Augmentation of fluid intake resulted in a notable increase in urinary water without appreciably enhancing the water balance or the water elimination through other channels.

Augmentation of food intake increased the elimination of water through the skin and lungs and the feces at the expense of urinary water.

Elevation of the environmental temperature from 22 to 29 C. (72 to 84 F.) in one observation strikingly increased the water eliminated through the skin at the expense of urinary water. Increasing the relative humidity from 40 to 80 per cent in another observation caused similar but less striking changes. In neither instance was fecal or retained water markedly affected.

CONCLUSIONS

A comprehensive system for studying the water exchange of infants and the results when average conditions of diet and environment prevail

are presented. The results in conjunction with data previously reported [1] indicate that the customary diets employed in infant feeding, containing approximately 120 calories, from 4 to 5 Gm. of protein and 160 Gm. of fluid per kilogram of body weight, are adequate to ensure the deposition within the body of organic materials and water which qualitatively approximate the chemical composition of infantile tissue and which quantitatively fulfil the requirements for satisfactory growth. The effects on the water exchange of variations in caloric and fluid intake and of environmental temperature and relative humidity were also studied. Such studies are a prerequisite for investigations of the water exchange of premature and of sick infants.

525 East Sixty-Eighth Street.

Case Reports

ALKAPTONURIA

SILBER C. PEACOCK, M.D.†
AND
KATHRYN KNOWLTON, S.M.
CHICAGO

A 13 month old girl was brought to our attention because her urine was reported to contain 2.5 per cent sugar. It was found that although 1 drop of the urine reduced Haines's solution it did not ferment dextrose, and addition of sodium hydroxide produced a black precipitate. The condition was recognized as alkaptonuria, and the patient was admitted to the Children's Memorial Hospital for further study.

This infant was born at full term with normal delivery. The parents were American; they were in good health and were not related. This was the first child, a miscarriage following a fall having terminated the only other pregnancy. The child was breast fed for five months, later receiving cow's milk and evaporated milk. Except for an injury to the head at the age of 9 months and an attack of diarrhea at 4 months, the child had always been well and the growth had been normal in all respects.

Physical examination revealed no abnormalities except rudimentary branchial clefts on the upper anterior portions of both external ears. In the mucous membrane of the gum below the left lower incisors there was a dark brown pigmented area about 1 cm. in diameter.

The parents stated that except during the first few days of life the urine had been dark and had stained the diapers red or black. This discoloration attracted little comment, for during the first three months of life the child had been receiving copper and iron by mouth, and the discoloration of the diapers was attributed to this. Although the dark color continued after discontinuance of the copper and iron, the family did not worry about it. The mother said that on certain days, irrespective of the diet, the diapers were practically white, but when even the white diapers were put into water it became pink. Ingestion of cane sugar or candies seemed to cause a deeper discoloration. The child did not take large quantities of fluid and had no abnormalities of appetite.

Laboratory examinations of the blood gave the following results: hemoglobin, 98 per cent; red corpuscles, 5,150,000 and white corpuscles 7,200 per cubic millimeter (lymphocytes 75 per cent, polymorphonuclears, 23 per cent). Chemical

From the Otho S. A. Sprague Memorial Institute Laboratory of the Children's Memorial Hospital.

† Among numerous pieces of unfinished work left by Dr. Peacock, who died Jan. 3, 1936, was a report of a case of alkaptonuria. As this condition is so rare that each case should be recorded, I have prepared Dr. Peacock's notes for publication.—H. Gideon Wells, Director.

analysis gave these figures (milligrams per hundred cubic centimeters): nonprotein nitrogen, 26.7; creatinine, 1.3 (whole blood) and 1.0 (plasma); uric acid, 3.4; plasma dextrose (Folin and Wu), 73, and nonfermentable reducing substances, such as dextrose, 27. The values for blood sugar obtained in a dextrose tolerance test were as follows (milligrams per hundred cubic centimeters): with the patient fasting, 50; forty minutes after administration of dextrose, 91; two hours after administration, 74. The protein content of the plasma (in grams per hundred cubic centimeters) was: total, 6.3; albumin, 4; globulin, 2; fibrinogen, 0.3. The albumin-globulin ratio was 2.

Examination of the urine by one of us gave these findings: The samples of urine were a light smoky brown, sometimes with a pinkish tinge. Qualitative tests for dextrose with Haines's solution showed marked reduction, but this was

Crystals of homogentisic acid isolated from the patient's urine.

not typical of the usual dextrose-containing urine. The cuprous oxide precipitate was red-brown and somewhat fluffy, while the supernatant fluid became dark.

The nature of the reducing substance was investigated further by a study of its fermentability with yeast and of its reaction with phenylhydrazine. No fermentation took place with a yeast preparation which had been found satisfactory by the use of both positive and negative controls. No osazone could be isolated by the technic described in Todd and Sanford's "Clinical Diagnosis by Laboratory Methods." The possibility of pentosuria was eliminated by a negative reaction with phloroglucinol.

Hence we were led to consider the possibility of alkaptonuria. The action of a 10 per cent solution of sodium hydroxide on alkaptonuric urine is typical, and the specimens examined showed the characteristic darkening with this reagent. At first the brown coloration was most marked at the surface, where the urine was in contact with the

oxygen of the air, but in time the fluid became black throughout. It is also known that homogentisic acid, to which the peculiar characteristics of alkaptonuric urine are due, is not able to reduce alkaline bismuth salts, though it does reduce copper. This was true of the specimens.

A small amount of homogentisic acid was isolated by the following procedure, modified from that given by various sources in the literature.

Neutral lead acetate was added in the proportion of 5 or 6 Gm. per hundred cubic centimeters of urine; the bulky precipitate of lead phosphate, lead carbonate, etc., which formed at once, was removed by filtration, and the clear filtrate was allowed to stand in the ice box until acicular crystals of lead homogentisate settled out. This occurred slowly (in two or three days) the first time, but after material was available for seeding, a few hours usually brought down the entire crop of crystals. These were removed by filtration with suction and were recrystallized once from hot water with animal charcoal. A pure white cystalline product resulted.

This was decomposed by passing washed hydrogen sulfide gas through its suspension in ether until no further darkening occurred. The ethereal solution was filtered from the precipitated lead sulfide and was evaporated to dryness. Slow evaporation left a residue of beautiful long white needles (figure). This material melted at 148 or 149 C. (uncorrected); the temperature may be compared with the melting point of 152 C., given in the literature.

COMMENT

In view of the familial character often exhibited by alkaptonuria, it is to be noted that no member of the family on either side was known to have alkaptonuria or diabetes, for which alkaptonuria is sometimes mistaken, except that the mother's father's mother was supposed to have had pancreatic disease with diabetes. Negative results were obtained on examination of specimens of urine from several relatives, namely, the father, the mother, the mother's mother, uncle and father and the father's mother.

Since alkaptonuria behaves as a recessive trait, a history of parental consanguinity is sometimes obtained,[1] but there was no known relationship between the parents of this patient.[2]

1. Cuthbert, C. F.: Heredity in Alcaptonuria, Lancet **1**:593, 1923.

2. In May 1938 the parents informed me that the child had continued in good health. She is now 4 years old. A sister born about two years previously has not exhibited any abnormal urinary condition.—H.G.W.

CALCINOSIS UNIVERSALIS WITH UNUSUAL FEATURES

ALLAN BLOXSOM, M.D.

AND

ROBERT A. JOHNSTON, M.D.

HOUSTON, TEXAS

A girl was delivered Jan. 1, 1937, at full term, weighing 5 pounds and 12 ounces (2,608 Gm.).

The mother was 19 years of age, and the patient was the result of the first pregnancy. The mother was first seen by one of us (R. A. J.) on July 30, 1936, giving an essentially normal history. Her tonsils and adenoids were removed several years previously. Her height was 5 feet and 1 inch (155 cm.) and her weight 100 pounds (45.4 Kg.). The menses started at the age of 13 years, occurred every twenty-eight days and lasted four or five days, with a moderate flow and no pain. The last menstrual period occurred on April 5.

Quickening was first noticed on August 17. On physical examination the mother was found to be essentially normal. Her teeth were normal, and there was no pyorrhea. Her blood pressure was 110 systolic and 70 diastolic, and her weight 100 pounds. The heart, lungs, and pelvic measurements were normal.

Laboratory studies showed the hemoglobin to be 65 per cent, the red blood count 3,480,000 and the white blood count 6,700. Wassermann and Eagle tests were negative; the clotting time was one minute and fifteen seconds. Because of the low hemoglobin content, the mother was given a gastric digestive enzyme and iron, and in October her hemoglobin content was 80 per cent. By this time she had gained 24½ pounds (11.1 Kg.). Her blood pressure and urine were normal.

The father was 30 years of age; his height was about 5 feet and 8 inches (173 cm.) and his weight 133 pounds (60.3 Kg.). There was no history of any other children on either side of the family with a condition like that reported here.

The baby was delivered after an easy labor that lasted eight hours. There was no evidence of calcification or fibrosis in the placenta. On physical examination the infant was found to be rather chubby. Her appearance was most unusual. Her head was considerably out of shape; her skin was red and felt thick, and over the entire body were cream-colored horny plaques that varied in size. Some could be detached from the underlying skin without causing any bleeding; others on being removed left a bleeding surface.

The wrists were flexed. The left leg was held flexed and could not be extended. The other extremities could be moved freely. The eyes were examined with difficulty; the pupils reacted to light. The mouth was normal, and the infant could suck vigorously. The heart and lungs were normal. The liver and spleen could not be palpated. The genitalia were normal. The muscles showed no hard masses, nor were there any nodules in the soft tissues.

Read before the Houston Pediatric Society on Aug. 16, 1937, and before the Memorial Hospital Staff on Sept. 7, 1937.

Because of the shortening of the left leg a roentgen study was made of the skeleton. Dr. Leonard Myers reported that "the entire skeletal framework showed multiple calcified areas throughout the cartilaginous portions of the long bones, and also a few calcified areas in the regions of the carpi, the tarsi and the cartilaginous portion of the wrist.

Laboratory studies gave the following findings: Wassermann and Kahn tests were negative. The hemoglobin content was 99 per cent and the red blood cell

Fig. 1.—*A*, dorsal view of the infant taken at birth. The white plaques were hard, and a few could be removed, in some instances leaving raw surfaces. *B*, ventral view. Note shortening of the left femur with flexion of the joint.

count 4,780,000; there were 11,250 white blood cells, with 34 per cent small lymphocytes, 61 per cent neutrophils, 4 per cent eosinophils and 1 per cent myelocytes. The calcium content of the blood on the third day was 15.4 mg. per hundred cubic centimeters and the phosphorus content 7.4 mg. A biopsy of the skin showed hyperkeratosis.

The child was given breast milk complemented with similac. Orange juice, brewers' yeast and haliver oil were added to the diet at the age of 2 weeks. At the end of the first month the child's skin appeared to have cleared somewhat. Her length was 17½ inches (44 cm.) and the circumference of her head 14 inches (36 cm.), and her weight had increased to 6 pounds (2,722 Gm.). The skin continued to clear; at the end of the second month the worst areas included

Fig. 2.—Section of skin taken from the buttocks, showing marked hyperkeratosis.

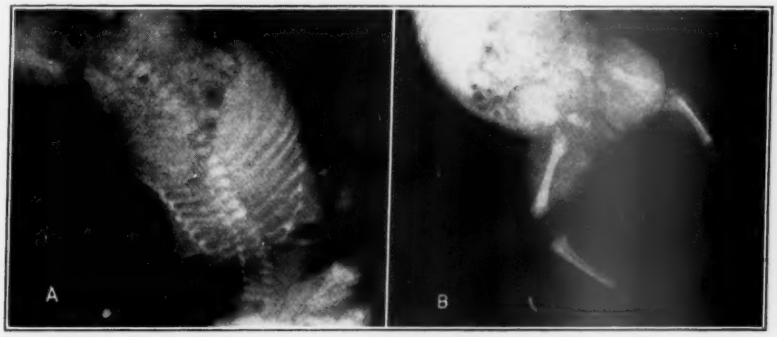

Fig. 3.—*A*, roentgenogram of the body taken a few hours after birth. Extensive deposits of calcium can be seen throughout the chest wall, in the cartilages of the ribs, along the vertebral column, over the crests of the pelvic bones and at the upper and lower ends of the left femur. *B*, roentgenogram of the lower extremities taken a few hours after birth. Extensive deposits of calcium can be seen at the upper and lower ends of the left femur, at the upper and lower ends of the left tibia and fibula, at the upper and lower ends of the right fibula and throughout both ankle joints. There is a small, beadlike deposit in the region of the right patella.

the scalp and part of the buttocks. The weight had increased to 7 pounds (3,175 Gm.). At this time a deep hemangioma appeared on the upper lip, for which the child received radium treatments. Another study of the calcium content of the blood was made at this time for the patient and for her mother, with the following results (the figures represent milligrams per hundred cubic centimeters):

Child		Mother	
Total calcium	11.7	Total calcium	10.8
Diffusible calcium	5.4	Diffusible calcium	7.0
Phosphorus	7.7	Phosphorus	4.7

At the end of the third month the baby's weight had increased to 8 pounds and 4 ounces (3,742 Gm.) and her length to 20¼ inches (51 cm.); she was looking

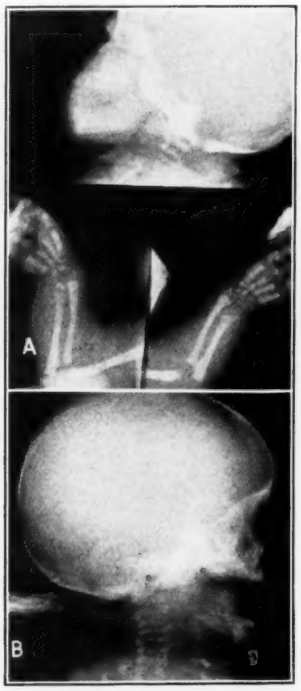

Fig. 4.—*A*, roentgenogram of the upper extremities taken a few days after birth. Note the extensive deposits of calcium in the wrists and in the cartilages of a few of the carpal bones. *B*, roentgenogram of the skull taken at birth. There is no evidence of any deposits of calcium in the cartilage of the flat bones.

around and seemed to be normal mentally. The left thigh continued to be held in a flexed position and was obviously much shorter than the right. At the end of five months the child's weight was 10 pounds and 6 ounces (4,706 Gm.), and at the end of seven months 11 pounds and 8 ounces (5,216 Gm.). Her skin has cleared a great deal; at present it appears thickened over the scalp and in some areas over the shoulders.

The child is now taking similac, halibut liver oil, orange juice, brewers' yeast, pablum, strained vegetable soup, yolk of egg, custard and jello. She moves her head and notices objects and will follow a person with her eyes. She seems

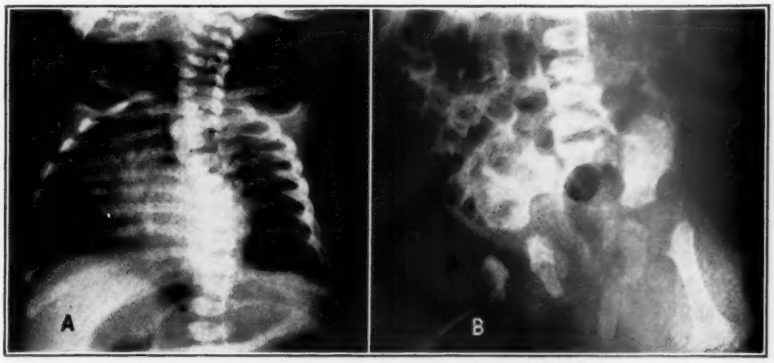

Fig. 5.—*A*, roentgenogram of the vertebrae and chest taken seven months after birth. The deposits of calcium have decreased along the vertebral column and throughout the wall of the chest. *B*, roentgenogram of the pelvic bones and left femur, showing marked decrease in the deposits of calcium over the crests of the flat bones and at the upper and lower ends of the femur.

Fig. 6.—*A*, roentgenogram of the femurs at the age of 7 months. Deposits of calcium have decreased at both ends of the left femur. Well developed epiphyses of the distal end of the right femur and of the proximal end of the right tibia have appeared. *B*, roentgenogram of the distal ends of the lower extremities at the age of 7 months. There are still marked deposits of calcium in the ankle and foot, but these are considerably less than at birth.

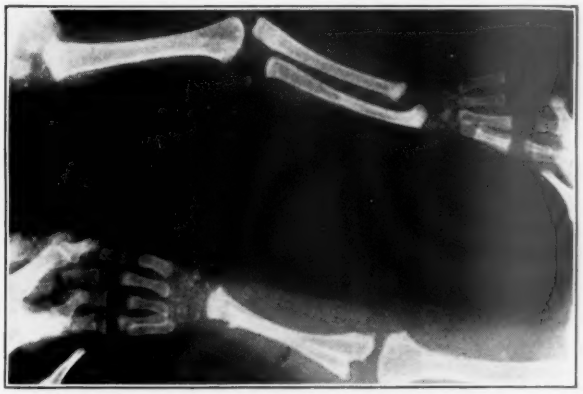

Fig. 7.—Roentgenogram of the upper extremities at the age of 7 months. Deposits of calcium are noticeable but not as marked as at birth.

to be in excellent condition; she weighs 11 pounds and 14 ounces (5,386 Gm.), her length is 24½ inches (62 cm.) and the circumference of her head is 17¼ inches (44 cm.).

COMMENT

This infant is interesting because, first, deposits of calcium in the epiphyses of the long bones, in the vertebra and in other bones of the skeleton have not been observed before; second, the occurrence of hyperkeratosis in association with calcinosis universalis has not been recorded; third, the condition occurred within the uterus, and, fourth, there has been a spontaneous tendency toward diminution of the deposits.

Deposits of calcium have been reported by Tisdall and Erb.[1] In their first case these occurred in the epiphyses at both ends of the humeri, at the proximal ends of the radiuses, ulnas and tibias and at the distal ends of the femurs, and both patellas were practically outlined by the deposits. There was also a flexion deformity which involved almost all the joints of the body. The infant died at the age of 9 weeks. Microscopic examination of the patella showed the bulk of the section to be cartilaginous. Scattered throughout the cartilage were areas of loose connective tissue in which many of the cells appeared to be undergoing degenerative changes, some of the nuclei being shrunken and the intercellular substance being vacuolated and granular. The deposits were found in these areas of degeneration. They apparently acted as a foreign body, since an occasional foreign body giant cell was seen at the periphery.

The shortening of the left femur in the case reported here was no doubt caused by the heavy deposit of calcium in the epiphyses, which interfered with the supply of blood to these parts.

The child seems to be making a spontaneous recovery. This suggests that some disturbance in the placenta or in the calcium metabolism of the mother during gestation overloaded the infant's blood with calcium, which was then deposited in the various regions of the body.

SUMMARY

A case of calcinosis universalis with unusual features, which occurred in an infant, is presented. Two theories are suggested to explain this condition.

NOTE.—Since the foregoing case report was submitted for publication, a congenital cataract has appeared in each eye. In November 1937 a cataract was visible in the right eye, and shortly thereafter one appeared in the lower half of the posterior part of the cortex of the left eye.

1. Tisdall, F. F., and Erb, I. H.: Report of Two Cases with Unusual Calcareous Deposits, Am. J. Dis. Child. **27**:28 (Jan.) 1924.

The cataract in the right eye is of sufficient size to cause the child to fixate with the left eye; when she does, the right eye converges from 25 to 30 degrees. After the first discission for congenital cataract in the right eye, the calcified plaque included about one half of the membrane. There has since been no absorption of this membranous material, which appears to be dense.

TENSION PNEUMOTHORAX IN NEWBORN

REPORT OF A CASE WITH RECOVERY

HARRY STRONGIN, M.D.
BROOKLYN

Recorded cases of pneumothorax in the neonatal period are so few that the occurrence of such a case is of interest to all physicians. Ruge,[1] in 1878, was the first to report a case of pneumothorax in the newborn. The condition was discovered at autopsy. Glaser and Landau [2] reviewed the literature carefully and collected and reported 17 cases, including 1 of their own. Five patients showing the condition called by these observers tension pneumothorax died. The general mortality rate was 47 per cent.

Owing to the increasing use of the x-ray apparatus for diagnostic purposes the number of reported cases of spontaneous pneumothorax in which the condition occurred in infants has increased. This is not surprising, as roentgenologic examination is indispensable to its early recognition. Since the appearance of the communication by Glaser and Landau, 11 additional cases of pneumothorax in the neonatal period have been reported. Folke [3] described a case in 1935; the patient was an infant who, after a hazardous delivery, with moderate asphyxia at birth, showed respiratory distress and difficulty in feeding. When the child was 3½ months of age, a diagnosis of partial pneumothorax was made on the basis of the roentgenologic picture. Holz,[4] in 1936, reported 3 cases of partial pneumothorax in the newborn; in 1 of these the pneumothorax occurred in a 3½ week old infant and was associated with a severe attack of bronchiolitis and bronchopneumonia. Van Ebbenhorst Tengbergen [5] reviewed 3 cases; all the patients were large infants. In all of these there was some degree of asphyxia, owing to the presence of one or two loops of cord around the neck. Heijbroek [6] added

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From the pediatric service of Dr. Benjamin Kramer, the Jewish Hospital.

1. Ruge, C.: Pneumothorax bei einen Neugeborenen, Ztschr. f. Geburtsh. u. Gynäk. **2**:31, 1878.

2. Glaser, G., and Landau, D. B.: Pneumothorax of the New-Born, Am. J. Dis. Child. **50**:986 (Oct.) 1935.

3. Folke, L.: Persistent Spontaneous Pneumothorax in Infants, Acta pædiat. **17**:426, 1935.

4. Holz, I.: Beitrag zur Frage des Spontanpneumothorax bei Neugeborenen, Kinderärztl. Praxis **7**:3 (Jan.) 1936.

5. van Ebbenhorst Tengbergen, J.: Pneumothorax bei Neugeborenen, Fortschr. a. d. Geb. d. Röntgenstrahlen **53**:240 (March) 1936.

6. Heijbroek, N. I.: Spontaneous Pneumothorax in the New-Born, Nederl. tijdschr. v. geneesk. **80**:2468 (May 30) 1936.

the records of 3 more cases to the literature; in his series all the infants were large at birth and were asphyxiated to some extent. All recovered spontaneously in a short time. Miller,[7] in 1937, reported an interesting case of pneumothorax in which, at autopsy, complete absence of the right pulmonary artery was revealed, with ischemia and resulting necrosis of the lung, productive of pneumothorax. In Miller's series of 11 cases the mortality rate was approximately 9 per cent, as compared to the 47 per cent reported by Glaser and Landau.[2]

REPORT OF CASE

My patient was a Negress. Her mother was a 26 year old primipara, who had entered the maternity division of the Jewish Hospital on Feb. 28, 1937. The antepartum picture, including the conditions revealed by examinations of the urine, blood pressure readings and a Wassermann test of the blood, was normal. The pelvic measurements were adequate. After thirteen hours the labor was terminated because of arrest of the fetal head in a transverse position at the spines. The head of the fetus was delivered with ease by means of manual rotation and by the application of midplane forceps. However, considerable difficulty was encountered in the delivery of the large shoulders. The infant was well developed, weighing 10 pounds (4,535 Gm.); she cried spontaneously and appeared to be in no respiratory distress. The general physical examination, performed in the delivery room immediately after the birth, showed no abnormal conditions.

Four hours after the birth the nurse noticed an increasing swelling of the upper part of the infant's chest and notified the intern. An examination at this time revealed an extremely distressed infant with rapid, shallow and irregular respirations. She was limp and did not respond to painful stimuli. Severe subcutaneous emphysema existed in both axillas and over the front and back of the chest, extending up both sides of the neck to the occiput. An examination of the chest revealed a hyperresonant percussion note throughout on both sides. Breath sounds were heard distinctly over the right side of the chest but were absent over the left side. The position of the heart could not be determined, but the sounds were feeble and distant and the rate was rapid. Both the liver and the spleen were palpable 2.5 cm. below the costal margin.

The infant was taken to the x-ray room, and by the time of arrival there she had ceased to breathe. She was placed under the fluoroscope, and I noted complete pneumothorax of the left side of the chest, with collapse of the left lung and displacement of the mediastinum and its contents to the right. The heart was beating slowly, at an approximate rate of 30 beats per minute. A 20 gage needle to which was attached a 20 cc. syringe was inserted into the left pleural cavity, and about 65 cc. of air was allowed to escape under pressure. Soon the heart was seen to shift over toward its normal position in the chest and to beat more rapidly, while the left lung began to reexpand. The child began to breathe spontaneously, her color improved and she was given continuous oxygen inhalation thereafter. Figure 1 shows the immediate improvement after the first thoracentesis.

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7. Miller, J. F.: Congenital Absence of Right Pulmonary Artery in a New-Born Infant with Resulting Necrosis of Lung and Spontaneous Pneumothorax, Am. J. Dis. Child. **53**:1268 (May) 1937.

A second thoracentesis was performed three hours later because of severe respiratory distress; at this time 35 cc. of air was allowed to escape. On the following morning the child took 3 ounces (84 Gm.) of food well and appeared to be comfortable. Thereafter improvement was progressive, and the child left the hospital on the tenth day, weighing 10 pounds and 11 ounces (4,876 Gm.), 10 ounces (280 Gm.) above her weight at birth. The final roentgenologic examination of the chest, on the sixth day of life, showed normal conditions.

About twenty-four hours after birth, examination revealed that the child had Erb's palsy involving the entire right upper extremity. This was subsequently treated in the orthopedic clinic. The infant was seen last by me on

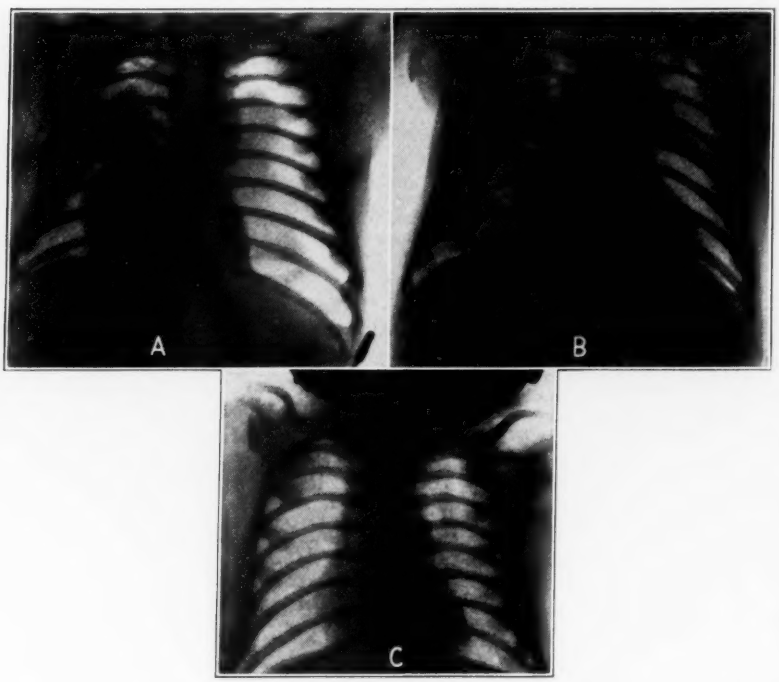

Fig. 1.—*A*, initial roentgenogram of the chest. Note the shift of the mediastinum to the right, the outline of the collapsed left lung, the pneumothorax on the left and the severe subcutaneous emphysema. *B*, roentgenogram of the chest, taken immediately after the first thoracentesis. *C*, roentgenogram taken five days after the onset of symptoms. The chest is entirely normal.

May 27, 1937, at 3 months of age. She weighed 15 pounds and 14 ounces (7,140 Gm.). Physical examination showed her to be entirely normal.

Unquestionably, the mechanical trauma of delivery played the major role in the production of this dramatic condition, for, as has been noted, the delivery was difficult. Erb's paralysis resulted as a consequence of this difficulty and the clinical signs of respiratory distress appeared a few hours after birth. The mechanism of the production of pneumo-

thorax in infancy is the same, no doubt, as in any other period of life and is usually due to the rupture of an alveolus or of alveoli. Willi [8] and Péhu [9] have discussed the etiology of pneumothorax in the newborn. They have contended that accurate diagnosis can with certainty be made only by roentgenologic examination and that even with such an examination, it is sometimes difficult to differentiate pneumothorax from a congenital balloon cyst of the lung. Stein [10] has stated that the case he reported in 1930 [11] as one of congenital pneumothorax was a case of giant balloon cyst of the lung.

The best form of therapy is prophylactic, the avoidance of unnecessary trauma at birth. When extreme mechanical distress is noted, as in the case reported, the treatment consists in withdrawing the collected air under tension. The prognosis depends on the underlying condition in the chest and on the size of the rent in the lung. If there is no associated infection in the lung and no congenital anomalies are present, the prognosis is good.

SUMMARY

A case of unilateral pneumothorax in the newborn, recognized four hours after birth, is reported. The recovery was spontaneous and dramatic after the simple withdrawal of air on two occasions during the first twenty-four hours of life. An unusual feature of this case was the presence of extensive subcutaneous emphysema, which disappeared promptly with the clinical improvement of the infant's condition. Pneumothorax in the newborn results from the trauma of birth; hence the study must extend over the first two or three weeks of life or longer. In any case of neonatal dyspnea, the chest should be examined both roentgenologically and fluoroscopically. In this way, many occurrences of the condition which are now overlooked would be recognized.

8. Willi, H.: Frühzeitiger persistierender Spontanpneumothorax im Säuglingsalter, Schweiz. med. Wchnschr. **64**:229 (March 10) 1934.

9. Péhu, M.: Sur le pneumothorax du nouveau-né, Paris méd. **2**:335, 1936.

10. Stein, J.: Personal communication to the author.

11. Stein, J.: Congenital Pneumothorax, Am. J. Dis. Child. **40**:89 (July) 1930.

PHOSPHORUS POISONING IN AN INFANT RESULTING FROM AN ANTIRACHITIC PREPARATION

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YELLOW SPRINGS, OHIO

Striations or bands of increased density in the diaphyses of bones of growing children have been described by several observers (Eliot, Souther and Park [1]; Miller and Rubell [2]; Weisse [3]; Hamperl [4]; Phemister [5]; Wegner,[6] and others). These bands are usually found between the ages of 12 months and 5 years. They appear to result most frequently from a disturbance of growth.

In this instance the temporary zone of calcification situated in that part of the cartilage which is about to be replaced by the invading osteoblasts seems to become more heavily mineralized concurrently with the retardation of the rate of invasion of osteoblasts (a part of the general slowing of the growth processes). The calcium in this temporary zone is ordinarily resorbed as the cartilage is replaced by osteoid tissue, which in turn becomes calcified. The temporary zone of calcification, which has become overmineralized as a result of the retardation of growth, when the calcium undergoes resorption and is replaced by osteoblasts may furnish its excessive mineral directly to the invading osteoid tissue when this resumes its growth, causing it, in turn, to become overcalcified. The resulting overcalcified band appears at the end of the bone as soon as growth of later osteoid tissue, which is normally calcified, has progressed far enough to differentiate this band from the receding temporary zone of calcification.

From the Fels Research Institute, Antioch College.

1. Eliot, M. M.; Souther, S. P., and Park, E. A.: Transverse Lines in X-Ray Plates of the Long Bones of Children, Bull. Johns Hopkins Hosp. **41**: 364, 1927.

2. Miller, L. F., and Rubell, I.: Transverse Lines in the Bones of a Tuberculous Child, Am. J. Dis. Child. **47**:354 (Feb.) 1934.

3. Weisse, O.: Phosphorus as a Cause for Shadows in Growing Bones, Monatschr. f. Kinderh. **57**:401, 1933.

4. Hamperl, H.: Die anatomischen Grundlagen und die Entstehung der sog. Querschatten in den Metaphysen wachsender Knochen, Ztschr. f. Kinderh. **56**: 324, 1934.

5. Phemister, D. B.: The Effect of Phosphorus on Growing, Normal and Diseased Bones, J. A. M. A. **70**:1737 (June 8) 1918.

6. Wegner, G.: Der Einfluss des Phosphors auf den Organismus, Virchows Arch. f. path. Anat. **55**:11, 1872; Ueber das normal und pathologische Wachstum der Roehrenknochen, ibid. **61**:44, 1874.

It is also possible that the deceleration in the rate of growth of the osteoid tissue during plateaus in growth may result in immediate overmineralization of the tissue most recently formed. It is well known that the most recently formed osteoid tissue is the most unstable as to mineral content, calcifying or decalcifying rapidly according to changing conditions of the body. Thus failure of the new tissue to develop at its usual rate should make available to this tissue a greater amount of the mineral supply of the blood than it would normally have. Resumption of the normal rate of growth, with normal calcification of the osteoid tissue beyond the more heavily calcified bands, would then delineate the striae as they are seen in roentgenograms.

Such bands or lines also occur in healing or healed rickets, lead poisoning, anemia, phosphorus poisoning and hypervitaminosis D.[7] Bars or rings from such causes are usually much broader and heavier than those resulting from fluctuations in the growth cycle. In the case of lead poisoning there is apparently superimposition of the heavy metal on the normal calcification at the ends of the diaphyses. There is probably also partial replacement of the calcium by lead. It is possible that the same process operates in the case of phosphorus poisoning.

It seems probable, however, that a major part of the excess of phosphorus is deposited in combination with calcium as an excessive amount of the normal calcium salt. Because of the presence of peculiarly available phosphorus in unusual amounts, more than the usual amounts of calcium salts are precipitated. Wegner, in 1872, first described the changes in the long bones of rats produced by feeding extremely small quantities of red phosphorus. Phemister, in 1918, described the bands seen on roentgen examination of children of 7½ years or more who had been given from $\frac{1}{400}$ to $\frac{1}{100}$ grain (0.16 to 0.65 mg.) of phosphorus daily. He observed these dense shadows resulting from small doses of phosphorus and attempted to evaluate the possible use of this mineral as a therapeutic agent for stimulating bone repair. Others since that time have described similar roentgen findings after administration of phosphorus. None of the reports that I examined, however, mentioned clinical symptoms caused by therapeutic doses of phosphorus, and none included cases in which the mineral was ingested during the first year of life. Because of this fact it seems worth while to present a case in which phosphorus was given therapeutically during the first few months of life and in which marked clinical changes in addition to changes in the bone appear to have resulted. It is of further interest that the source of the phosphorus was apparently a commercially prescribed antirachitic preparation.

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7. Miller and Rubell.[2] Weisse.[3] Hamperl.[4] Phemister.[5] Wegner.[6]

REPORT OF A CASE

J. Z., a boy, was born in April 1932. The weight at birth was 6 pounds and 4 ounces (2,835 Gm.). He was the first child of an apparently normal woman aged 30 years. The pregnancy was uneventful. Two Wassermann tests on the blood of the woman were negative. Her diet was considered average in calcium, phosphorus, protein and vitamin D content. Delivery, which occurred at term, was uneventful. Physical examination at birth showed no evidence of birth injury or of gross abnormality. The child was breast fed for the first two months, being given five feedings every twenty-four hours.

At the age of 1 month daily administration of 4 cc. of a preparation of cod liver oil and malt, which contained, according to the manufacturer, $\frac{1}{64}$ grain (1.1 mg.) of pure phosphorus per fluid ounce (29.6 cc.), was started for the prevention of rickets. Since the dose initially was $\frac{1}{8}$ ounce (3.7 cc.) per day, the child at the age of 4 weeks actually took a trifle less than $\frac{1}{500}$ grain (0.15 mg.) of phosphorus per day. The dosage was increased during the next four weeks to $\frac{1}{2}$ ounce (14.8 cc.) or $\frac{1}{128}$ grain (0.5 mg.) of phosphorus per day.

Sun baths were started at six weeks. These were gradually increased until the child, wearing only a diaper, was exposed to the sun for about thirty minutes in the middle of the afternoon each day. He received his maximum dosage of sunlight during July and August, when he was from 3 to 4 months old. He received orange juice from the age of 4 weeks. At 2 months supplementary feedings were started which consisted of corn syrup and equal parts of cow's milk and water. Later this mixture was strengthened, and at 6 months strained vegetables and prunes were added.

His weight and height curves are shown in figure 1. Up to the age of 4 months his gain in weight was rapid. From $4\frac{1}{2}$ to 6 months he gained no weight, and from 6 to 7 months he gained slowly. During this period the child's turgor became poor. His skin assumed a transparent appearance, and his veins became prominent. He grew lethargic, and his behavior was less mature than that of the average child of the same age. There was no vomiting or diarrhea. The appetite declined somewhat. Although he looked anemic, his blood cell picture was normal. The calcium and phosphorus content of the serum could not be determined, because of objections by the parents. The boy had no fever. At the age of 7 months the mixture of cod liver oil and phosphorus was discontinued, and a fortified cod liver oil was substituted. In the first two weeks following this change the child gained 11 ounces (312 Gm.). His general condition was much improved. His progress from this point was uneventful. He rapidly lost his lethargy, and his turgor rapidly became normal. Motor development progressed normally.

Roentgenograms taken at the age of 6 months show broad bars or bands in the ends of all the long bones (fig. 2 *A* and *B*). These bars are of the broad type usually associated with heavy metal poisoning. The temporary zones of calcification are also markedly thickened and unusually dense. At the age of 9 months the temporary zones of calcification are approximately normal, but there has appeared in the ends of the diaphyses a second heavy band even thicker than the first (fig. 2 *C*). Subsequent roentgenograms showed this dense line in the pelvic, metacarpal and metatarsal bones and in the nuclei of the tarsal bones.

Since the child's physical condition had been poor during formation of these bands (from about the fourth to the seventh month), the blood was examined for evidence of lead poisoning. Paints from his crib, basket and toys were analyzed for lead, but all findings were negative. The child showed no evidence of diabetes, anemia or tuberculosis either when he was receiving phosphorus or later. He is

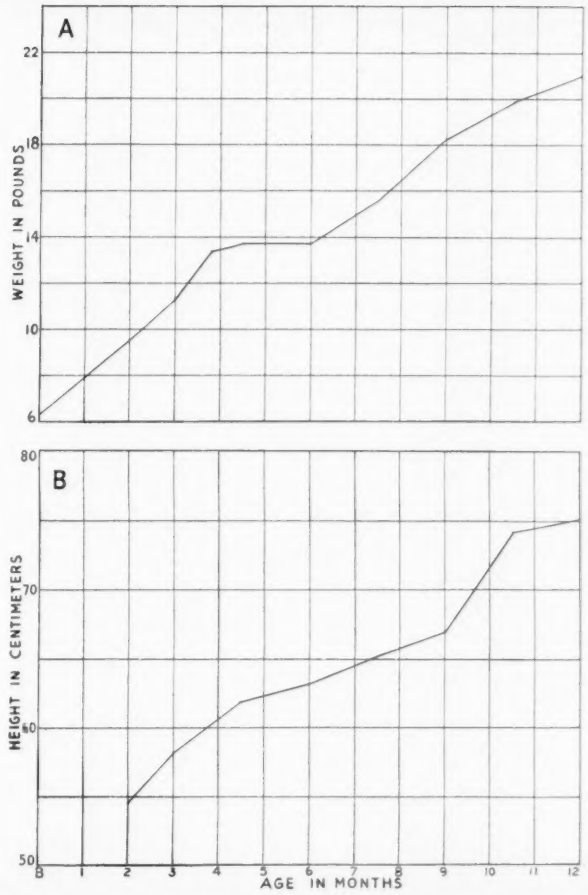

Fig. 1.—Growth during the first year. *A*, weight curve, and *B*, height curve.

Fig. 2.—Roentgenograms showing changes in the ends of the long bones. *A* and *B* were taken at the age of 6 months and *C* at 9 months.

now, at the age of 5 years, a normal but rather heavy child. He still has vestiges of the second of the two bars in the ends of the long bones. In his most recent roentgenogram they are 5.5 cm. from the proximal end of the tibia.

My conclusion is that this is a case of phosphorus poisoning. Harris and Innes,[8] Sontag, Munson and Huff[9] and others have shown that in rats toxicity from heavy dosage of vitamin D is greatly enhanced by large quantities of calcium or phosphorus in the diet. Conversely, there is evidence that the toxicity of phosphorus may be greatly exaggerated by large quantities of vitamin D. The child took rather large doses of phosphorus, which with the aid of the heavy dosage of cod liver oil and the sun baths produced clinical as well as roentgen evidence of phosphorus poisoning.

SUMMARY

Cessation of growth in young children may produce fine transverse lines or bands in the ends of the long bones. This process is probably due to excessive exposure of the new osteoid tissue to mineralization. The administration of heavy metals and certain chronic diseases may also produce bands in the ends of bones, but these are much thicker and heavier, and in the case of the heavy metals the process is different.

A case of phosphorus poisoning in an infant is presented in which clinical as well as roentgen changes resulted from large doses of a preparation of cod liver oil and phosphorus. It is believed that sun baths and excessive vitamin D intake increased the toxicity of the phosphorus.

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9. Sontag, L. W.; Munson, P., and Huff, E.: Effects on the Fetus of Hypervitaminosis D and Calcium and Phosphorus Deficiency During Pregnancy, Am. J. Dis. Child. **51**:302 (Feb.) 1936.

SPLENECTOMY AND LIGATION OF GASTRIC CORONARY VESSELS

EFFECT ON ESOPHAGEAL VARICES IN A CASE OF BANTI'S SYNDROME WITH EARLY HEMATEMESIS

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Objective evidence that esophageal varices occurring in Banti's syndrome can be reduced in size by splenectomy and ligation of the gastric coronary vessels has not been presented. Such evidence was obtained both roentgenographically and endoscopically in the case to be reported.

The surgical procedure differed from the usual one in that the coronary artery of the stomach was ligated as well as the coronary vein in order to reduce further the load on the varicosed esophageal veins.

REPORT OF A CASE

The patient, a boy of 7 years, was admitted to the pediatric ward of the Hospital of the University of Pennsylvania to the service of Dr. J. C. Gittings on Feb. 23, 1936, for treatment of hematemesis. Massive hematemesis had occurred in August 1935.

Little is known of the patient's antecedents. The mother was mentally defective. The boy was born at term by spontaneous delivery and appeared to be normal at birth. He was reared by foster parents. He had measles at the age of 2 years and impetigo at 4 years. Tonsillectomy and adenoidectomy were done at 3 years. Examination on Sept. 13, 1934, at St. Luke's Hospital, Bethlehem, Pa., showed a palpable spleen and a loud, booming systolic murmur.

The blood coagulation time was five minutes and the bleeding time four and one-half minutes; there were 183,300 platelets per cubic millimeter. The hemoglobin content was 11 Gm. per hundred cubic centimeters, or 64 per cent; there were 3,950,000 red cells and 6,600 white cells per cubic millimeter. On September 27 the blood was reported to be normal.

At the time of the patient's admission to the Hospital of the University of Pennsylvania the spleen was palpated 6 cm. below the costal margin. The systolic murmur was again noted, and there was marked pallor. Hypospadias was observed. The blood contained 59 per cent hemoglobin. There were 3,700,000 red cells per cubic millimeter and 7,800 white cells, of which 76 per cent were polymorphonuclear leukocytes, 18 per cent lymphocytes and 6 per cent monocytes. There were 0.9 per cent reticulocytes and 192,000 platelets. The coagulation time

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was eight minutes and the bleeding time two minutes; the clot retraction was firm. A fragility test showed that hemolysis began in a 0.475 per cent solution of sodium chloride and was complete in a 0.300 per cent solution, whereas with the blood of a normal control hemolysis began in a 0.475 per cent solution and was complete in a 0.350 per cent solution. The direct van den Bergh reaction was delayed, and the indirect was ± 0.2 unit. The Kahn and Kolmer tests for syphilis were negative. The Schick test was negative, as was the reaction to 0.01 mg. of old tuberculin. The electrocardiogram showed left axis deviation, with normal rhythm and a PR interval of 0.12 second. The orthodiagram of the heart

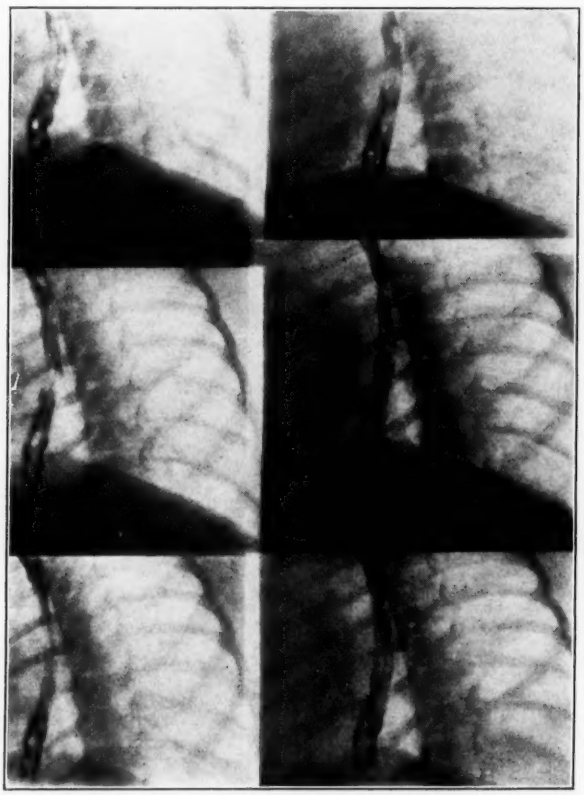

Fig. 1.—Serial roentgenograms of the esophagus before operation, showing numerous large varices.

showed normal size; the shape suggested left ventricular hypertrophy. The great vessels appeared normal. The exercise tolerance was normal. Roentgen examination of the esophagus showed large esophageal varices (fig. 1). Dr. Gabriel Tucker confirmed this finding by esophagoscopy on March 6. He reported that the lower part of the esophagus showed enormous dilatation of the veins and that the enlarged veins projected into the lumen of the esophagus from all sides, resembling earthworms. There was no ulceration or bleeding. The esophagoscopic diagnosis was "very extensive varicosities in the lower end of the esophagus." The clinical diagnosis was Banti's syndrome.

On March 13 the patient was transferred to the service of Dr. I. S. Ravdin for splenectomy. Operation was deferred because of an infection of the upper respiratory tract. During the night of March 15 severe hematemesis began; this continued at intervals for two days. In spite of three transfusions, shock developed, and for forty hours the patient's condition was critical. Bleeding finally stopped. The hemoglobin content, which had fallen to 49 per cent, was restored to 72 per cent by means of four additional transfusions, and on March 24 operation was carried out by Dr. Ravdin. As the patient's condition was somewhat precarious, 200 cc. of citrated blood and 1,000 cc. of a saline solution containing 5 per cent dextrose were given intravenously during the operation. Immediately before the splenic pedicle was clamped, 2 minims (0.12 cc.) of a solution of epinephrine hydrochloride (1:1,000) was given hypodermically to produce contraction of the spleen. The spleen was large and was adherent to the stomach and to the parietal peritoneum. In addition to removal of the spleen, the coronary vein and

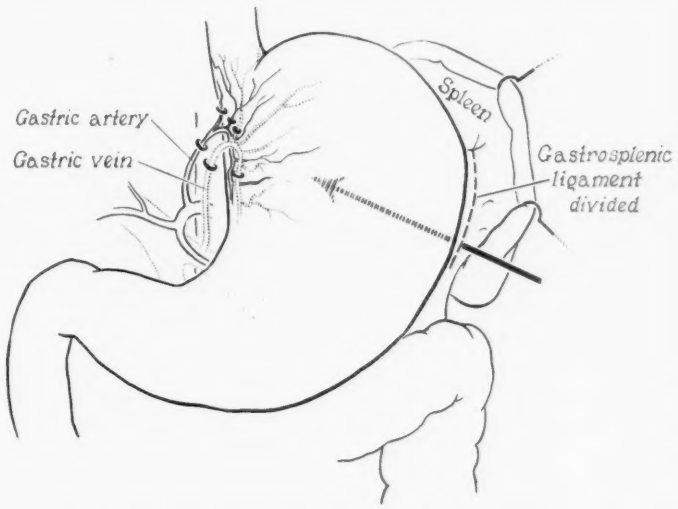

Fig. 2.—Diagram of the operative approach to the coronary vein and artery of the stomach.

the left gastric artery were ligated by the anterior and posterior gastric routes. Recovery from operation was smooth and was not complicated by further hemorrhage.

On April 14 esophagoscopy was again done by Dr. Tucker, who reported that there were dilated veins in the lower part of the esophagus but that they were much less distended than before the operation and no longer blocked the lumen of the esophagus. The platelet count rose from 152,000 on February 16 to 402,000 on March 30. Before the patient left the hospital the hemoglobin content had risen to 76 per cent. He was discharged on April 18.

The pathologic report stated that the spleen weighed 145 Gm. There was destruction of the architecture of the spleen, with diminution of the number of the active lymph follicles and marked increase in prominence of the fibrous trabeculae. The pathologic diagnosis was Banti's disease.

On June 28 the patient returned for examination; he had been well during the interval. The hemoglobin content was 80 per cent; the red cells numbered 4,200,000 and the white cells 10,800, with 50 per cent polymorphonuclear leukocytes, 35 per cent lymphocytes, 5 per cent monocytes and 10 per cent eosinophils. Fluoroscopic examination of the esophagus showed residual evidence of varicose veins. Esophagoscopy by Dr. Tucker still showed considerable dilatation of the veins in the lower end of the esophagus. The projections, however, were smaller than at the previous examination.

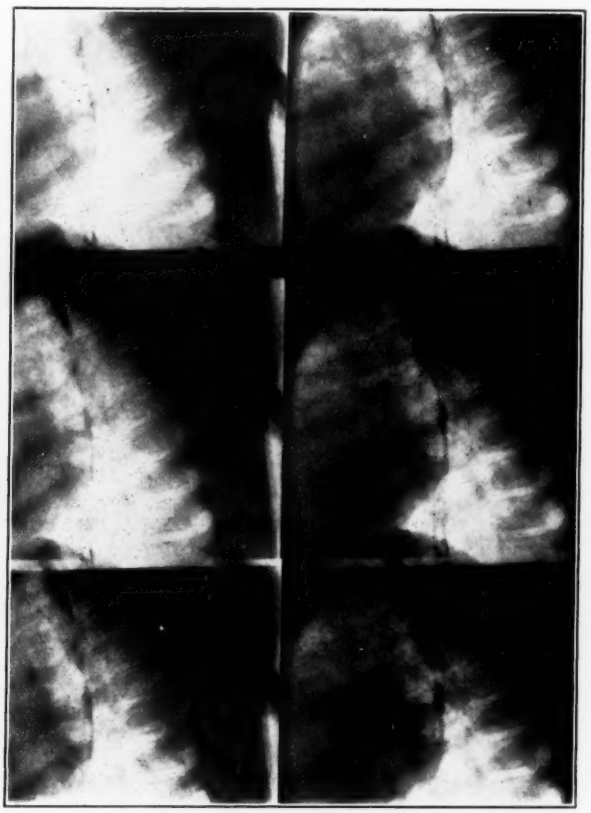

Fig. 3.—Serial roentgenograms of the esophagus eighteen months after operation, showing reduction in the size and number of varices.

The patient returned on October 19. He had been well in the interval except for a cold, which he still had. The blood showed the hemoglobin content to be 68 per cent; red cells numbered 4,200,000 and white cells 18,000, with polymorphonuclear leukocytes 69 per cent, lymphocytes 15 per cent, monocytes 5 per cent, eosinophils 11 per cent and platelets 311,000. Roentgen examination showed that the esophageal varices were neither as numerous nor as prominent as at the previous examination. Esophagoscopy on October 10 again showed veins that were dilated but not distended. On October 29 the patient had hematemesis for the first time since the operation. He vomited a considerable amount of blood at

intervals during the day and a small amount on October 31. He was supported with transfusions and recovered without further difficulty. He was discharged on November 11.

A third follow-up examination was obtained on Sept. 11, 1937. During the interval the patient had had two additional hemorrhages. On September 13 the hemoglobin content of the blood was 44 per cent, the red blood cell count 3,780,000, the white blood cell count 16,000 and the platelet count 310,000. The differential count showed 54 per cent polymorphonuclear leukocytes, 43 per cent lymphocytes, 1 per cent monocytes and 2 per cent eosinophils. Another series of roentgenograms was made of the esophagus. The varicosities were still demonstrable but appeared much smaller than in the original series (fig. 3).

COMMENT

The syndrome described by Banti [1] consists of splenomegaly, anemia and hepatic cirrhosis. For many years it was spoken of as a disease entity, but it is now generally considered that the syndrome probably is not a single disorder but a group of disorders.

In many of the patients ascites and esophageal varices develop. The latter commonly lead to hematemesis, although there are those who believe with Harvier and Maison [2] that hematemesis may result from a diffuse oozing from the mucous membrane of the stomach. In the majority of patients ascites is an earlier and more prominent feature of the syndrome than is hematemesis. There is, however, a smaller group of cases, occurring in children, in which hematemesis is an early and severe symptom and ascites, if it occurs at all, comes on late in the course of the disease. Thirty-six such cases were reported by Smith and Howard [3] and Smith and Farber.[4] Twenty-one of these cases were collected from the literature. Our case seems clearly to belong to this group.

The development of esophageal varices is believed to be due to an elevation of the venous pressure in the portal system. In the usual case of Banti's syndrome, when the process is advanced the liver has the appearance of Laënnec's cirrhosis, and portal obstruction may be thought of as due to generalized hepatic fibrosis. In Smith and Farber's [4] cases, however, the changes in the liver were much less developed. Obstruction of the splenic vein by thrombosis was found a number of times. In one of their cases valves were found which partially occluded the portal vein. An isolated case of splenomegaly with hematemesis was ascribed to thrombosis resulting from an old bullet wound (Monauni

1. Banti, G.: Semaine méd. **14**:318, 1894.

2. Harvier, P., and Maison, E.: Bull. et mém. Soc. méd. d. hôp. de Paris **50**:320, 1934.

3. Smith, R. M., and Howard, P. J.: Early Occurrence of Gastric Hemorrhage in Children with Splenomegaly, Am. J. Dis. Child. **34**:585 (Oct.) 1927.

4. Smith, R. M., and Farber, S.: J. Pediat. **7**:585, 1935.

and Bartsch [5]). In the case presented here no evidence of thrombosis of the splenic vein was found at operation, but the condition can be excluded only by autopsy.

Spontaneous remissions, which are frequent, make it difficult to evaluate treatment, but the only treatment which offers any hope of permanent cure is splenectomy. Although the results are rather uncertain, the operation has produced enough good results to justify the risk. According to Mills,[6] the results are much better if the operation is performed before ascites or hematemesis has appeared. In most cases splenectomy is followed by temporary improvement at least, but recurrence of hematemesis has occurred as late as ten years after the operation (Boyd [7]).

Good results have been widely reported (Caucci and Conforto,[8] de Sala, Parreño and García Morán,[9] Zagami,[10] Péhu and Rougier,[11] Weiskittel,[12] Mallet-Guy,[13] Canavero,[14] Macera and Oyhenart,[15] Royster, Haywood and Wilson,[16] Chabrol, Maximin and Porin [17] and Opitz [18]).

Other authors (Galán,[19] Raisch,[20] Monauni and Bartsch,[5] Harvier and Maison,[2] Rosenthal,[21] Boidin [22] and Moyer [23]) have reported rather poor results. Most of the authors with considerable experience have

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6. Mills, E. S.: Canad. M. A. J. **33**:480, 1935.
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16. Royster, H. A.; Haywood, H. B., and Wilson, W. G.: South. Med. & Surg. **97**:665, 1935.
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18. Opitz, H.: Jahrb. f. Kinderh. **107**:211, 1924.
19. Galán, J. C.: Rev. Assoc. méd. argent. **49**:839, 1935.
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21. Rosenthal, N.: Clinical and Hematologic Studies on Banti's Disease: Blood Platelet Factor with Reference to Splenectomy, J. A. M. A. **84**:1887 (June 20) 1925.
22. Boidin, L.: J. méd. franç. **19**:311, 1930.
23. Moyer, J. S.: Esophagoscopic Study of Esophageal Varices, Arch. Otolaryng. **10**:409 (Oct.) 1929.

reported both good and bad results (Delarue and Maison,[24] Smith and Farber,[4] Wallgren [25] and Smith and Howard [3]).

Mallet-Guy [13] stated that to be successful splenectomy must be performed before thromboses have occurred. Rosenthal [21] pointed to the danger of extensive postoperative thromboses associated with the rise in platelet count commonly noted after splenectomy. He warned against performing the operation when the platelet count is high.

In cases in which hematemesis has occurred, especially when esophageal varices are demonstrable, ligation of the coronary vein has been practiced (Walters, Rowntree and McIndoe,[27] Rowntree and McIndoe,[28] McIndoe,[29] Smith and Farber [4] and others). In our case the procedure was extended by Dr. I. S. Ravdin to include ligation of the coronary artery of the stomach as well as the vein, a procedure which has also been used by Cole.[29a] This appears to us a rational procedure, as it must eliminate a part of the normal load carried by the veins draining this area.

Whether surgical treatment had been effective in reducing the size of the varices remained doubtful. Moyer [23] examined two patients by esophagoscopy after splenectomy had been done and found that the varices persisted in both cases. Kirklin and Moersch [30] had the opportunity to examine one patient with esophageal varices both before and after splenectomy and found no roentgen change in the varices. Smith and Farber [4] estimated that splenectomy reduces the load on the dilated veins at least 20 per cent but stated that there is no evidence that the veins are reduced in size.

SUMMARY

A case of Banti's disease with esophageal varices and early hematemesis is reported.

Ligation of the left gastric artery as well as of the coronary vein was practiced at the time of splenectomy.

Direct evidence that the operation was followed by reduction in the size of the varices is presented.

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Progress in Pediatrics

ACUTE INFECTIOUS GINGIVOSTOMATITIS ("VINCENT'S STOMATITIS")

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Acute diseases of the mouth are more common in infants and children than in adults. Most prevalent in the neonatal period, thrush is seldom seen after the teeth begin to erupt. During the second year another oral disease, characterized primarily by intense inflammation of the gums, oral fetor, fever and acute swelling of the regional lymph nodes, begins to appear with rapidly increasing frequency, reaching a peak in the third year, when it becomes the commonest of the acute diseases of the mouth which occur at any age. The purpose of this paper is to report the results of a clinical and microscopic study of 69 cases of this disease, which is variously known as Vincent's stomatitis, Vincent's angina, ulcerative or ulceromembranous stomatitis, necrotic stomatitis, fusospirochetal stomatitis, aphthous or aphthoulcerative stomatitis, trench mouth, etc. There are in all over thirty synonyms.[1]

This study was undertaken originally at the suggestion of Dr. H. K. Faber, the purpose being to determine the merits of parenterally administered sulfarsphenamine by treatment in alternate cases. The scope has been considerably extended in an attempt to clarify somewhat the classification of stomatitis as it occurs in children, to evaluate the significance of the so-called Plaut-Vincent organisms, to define more precisely the characteristic symptoms and course of the disease, to show some of the epidemiologic features and, finally, to discuss the effects of treatment.

SELECTION OF CASES

Since there is no single pathognomonic sign or symptom or diagnostic laboratory test for this disease, the selection of cases had to be empiric. All of the children were under 15 years of age. The clinical feature common to all was gingivitis. In addition, one or more of the following symptoms were present in every case: oral fetor, swelling of the regional lymph nodes, fever and aphthous ulcers of the oral mucous membranes.

From the Rees-Stealy Clinic and Stanford University School of Medicine, Department of Pediatrics, San Francisco, and the Children's Hospital, Philadelphia.

1. Box, H. K.: Necrotic Gingivitis, Toronto, University of Toronto Press, 1930.

During the entire course of the study only 3 cases of acute gingivitis were found unacceptable. In every case scurvy, thrush, diphtheria, agranulocytosis, leukemia and mercury poisoning were ruled out. Despite the unavoidably empiric method of selection, the striking uniformity of the clinical course in all cases indicated that one was dealing with an entity. On the other hand, as will be shown, many of the cases at one period or another could have been variously classified according to any one of the thirty or more synonyms in more or less general use.

NOSOLOGY

The terminology of this disease is in the utmost confusion. When the specific cause is unknown, the name of a disease should be descriptive of the essential or characteristic pathologic change. No term now in general use accurately reflects the essential character of the disease, and several of those commonly used imply causes and characteristics that do not agree with known facts or even with probabilities. Cases of the disease in question are listed in the *Quarterly Cumulative Index Medicus* at the present time under "stomatitis, ulcerative," or more commonly "angina, Vincent's." The "Standard Classified Nomenclature of Disease" [2] offers the choice of "stomatitis, infectional," "stomatitis, aphthous," or "stomatitis, Vincent's angina."

It is impossible with the present state of knowledge to give an etiologic designation; thus it would be well to avoid such a term as fusospirochetal stomatitis. Neither Plaut [3] nor Vincent [4] in the original publications described cases of the disease in question. For this reason and also because of the etiologic connotation, their names cannot properly be applied to the disease. Especially objectionable and in fact absurd is the term Vincent's angina. The word angina, derived from the Greek word ἀγχόνη, meaning a throttling, should properly be applied only to afflictions which produce choking or strangling sensations or to severe diseases of the throat or fauces. Frühwald [5] was the first investigator to find the oral anaerobes associated with acute stomatitis, whereas Bernheim [6] gave the first clear clinical description of the disease. The terms ulcerative stomatitis and ulceromembranous stoma-

2. Standard Classified Nomenclature of Disease, compiled by the National Conference on Nomenclature of Disease, Chicago, American Medical Association, 1937.

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5. Frühwald, F.: Ueber Stomatitis ulcerosa, Jahrb. f. Kinderh. **26**:200, 1889.

6. Bernheim, J., and Pospischill, D.: Zur Klinik und Bacteriologie der Stomatitis ulcerosa, Jahrb. f. Kinderh. **45**:434, 1897.

titis lay too much emphasis on ulceration, whereas actually ulceration is often minimal or absent; moreover, both of these terms are often used to describe oral ulcerations of other types. Necrotic gingivitis is an objectionable term, as it suggests a greater degree of severity than ordinarily exists. Aphthous stomatitis is a term usually applied to soreness of the mouth in which gingivitis is minimal or absent and the characteristic lesions are "aphthous" ulcers. The word aphthous, originally applied to thrush and more recently to superficial small ulcers of the oral mucosa is one of those pretentious medical terms without etiologic significance and of poor descriptive value which richly deserve to be discarded from standard usage. Trench mouth is a popular, not a medical, term.

I hesitate to add another term to the already extended list of designations for this disease; but just as the results of the present clinical analysis of the material show that the disease corresponds rather poorly with the best known descriptions, so none of the current terms is acceptable. The disease is primarily an acute stomatitis, presumptively infectious. The principal site of the lesions is the gums. Thus I suggest the term "acute infectious gingivostomatitis" as preferable to any of those now in use. It will be employed in this paper.

CLINICAL MATERIAL

During the two years and nine months from September 1934 to June 1937 a series of 37 consecutive cases of acute infectious gingivostomatitis were subjected to clinical and laboratory study at the children's clinic of the Stanford University School of Medicine in San Francisco. To these were added 6 well documented cases observed in the fall of 1933. Between October 1935 and April 1936, 26 cases were similarly studied at the outpatient department of the Children's Hospital of Philadelphia. This made a total of 69 cases. All but 15 of the patients were under the care of one examiner.

Method of Study.—The general health of the child, the dietary habits, a previous history of soreness of the mouth, previous oral hygienic measures and the possibility of exposure to any one known to have a sore mouth were first noted. The history of the present illness was taken, with special attention to the nature, duration and order of appearance of the prodromal symptoms. Leading questions were carefully avoided. Each child was physically examined, and a smear was taken from the lesions for microscopic examination. During the study in every case the mother or attendant of the child was told to keep the mouth as clean as possible, frequently washing with warm dilute salt solution and, as soon as pain and tenderness had subsided sufficiently to permit, using a soft toothbrush with a soapy dentifrice several times a day.[7]

7. A prescription for a suitable dentifrice is one recommended in Accepted Dental Remedies, American Dental Association, Council on Dental Therapeutics, Chicago, 1935:

Calcium carbonate, precipitated	95 parts
Castile soap (hard soap)	3 parts
Saccharin	⅛ part
Methyl salicylate	1 part
Oil of peppermint	½ part

In the first 63 cases, alternate patients were given intragluteal injections of 15 mg. of sulfarsphenamine per kilogram of body weight. All children were seen every two, three or four days until the tissues of the mouth had returned to a normal condition, as far as could be seen with the naked eye. This was taken as the end of the disease, even though in many cases symptoms had previously disappeared.

Examination of the data thus obtained affords a somewhat different impression of the disease than one obtains from textbook descriptions. Nowhere in the literature can one find a large series of well documented serial cases, especially such a group as the 38 cases in which little or no treatment was given except local cleansing. It is from the untreated patients that one may glean the facts necessary for an understanding of the natural history of a disease. These facts in turn provide a guide by which the efficacy of treatment may be judged.

ANAEROBIC FLORA OF THE MOUTH

Because the oral "fusospirochetal" organisms, which are commonly present in great numbers in the lesions of acute infectious gingivostomatitis, have long been looked on as of more or less definite etiologic importance in this and in other diseases, it would be well to summarize what is actually known concerning their nature and behavior both in healthy and in diseased persons. It is well known that the normal oral and pharyngeal cavities of children harbor a variety of aerobic bacteria. The most common flora consists of streptococci, staphylococci, micrococci and pneumococci. Occasionally one may encounter a number of other aerobic organisms. Any of these may be present in the absence of any visible oral lesion. Less commonly realized, but equally true, is the fact that the normal child's mouth usually harbors one or more members of a group of anaerobic organisms which have been classified by Smith [8] under four headings:

1. Spirochaetae
   - Treponema microdentium
   - Treponema macrodentium
   - Treponema vincenti
   - Treponema buccale
2. Bacillus fusiformis
   - Type I
   - Type II
   - Type III
3. Spirilla
4. Vibriones

Throughout the rest of this paper the term "oral anaerobes" is used to refer to this group of anaerobic organisms. They are difficult to grow in pure culture, but as observed alive under the dark field apparatus they have characteristics which ensure easy morphologic identification

8. Smith, D. T.: Oral Spirochetes and Related Organisms in Fuso-Spirochetal Disease, Baltimore, Williams & Wilkins Company, 1932.

of the various groups and subgroups. It should be strongly emphasized that the criteria necessary for positive biologic identification and definite classification of most of these organisms are not yet well established.

Spirochaetae.—When material from a normal gingivodental sulcus is studied by the dark field method, many fields show only masses of food débris in which moving organisms are indistinctly seen. In places one may find lakes of oral secretion in which the organisms are free to move about unhindered by solid material. Attention is immediately attracted to the vigorous activity of the spirochetes. T. vincenti (Blanchard) is easily identified. It has loose, variable coils which reflect the light irregularly. As the organism moves it flexes itself frequently. Its motion is rapid but is interrupted every few seconds by a brief pause. It moves equally well in either direction along its long axis. When moving in a given direction it often continues in the same direction after several of its numerous periods of rest. Sometimes it will wriggle aimlessly without any forward progress. When it encounters an obstacle it usually wriggles on through, and it is surprisingly successful in penetrating fairly large masses of débris. Most specimens are uniform in length (12 to 14 microns) and in width (0.4 micron).

T. macrodentium and T. microdentium are similar to one another except for size. T. macrodentium is about the same length as T. vincenti, but it is a little narrower. T. microdentium is considerably narrower (0.2 micron) and is usually 4 or 5 microns shorter. These organisms have fixed coils which reflect the light evenly but not quite so brightly as T. vincenti. They differ from T. vincenti also in that they do not flex so much when moving, are prone to have somewhat longer periods of rest and move in a more sedate and orderly fashion.

T. buccale, which is seen much less frequently and in fewer numbers than the other spirochetes, has the appearance and motion of a minute snake. It is so broad (0.6 to 0.8 micron) that it may present a double contour under the dark field. It is usually about 15 microns in length. Its coils are not fixed, and it moves in a sinuous manner much like that of a crawling serpent; it sometimes moves rapidly but more often rather slowly.

My associates and I have not seen any oral spirochetes which morphologically did not readily fall into one of the groups just cited. Of course it is not to be assumed that similarity of form and motion is proof of biologic identity. There are not enough cultural and immunologic data concerning these organisms to provide adequate criteria for final classification.

Bacillus fusiformis.—The type I bacillus is long (3 to 20 microns) and broad (0.6 to 0.8 micron), has a double contour and is motile. It moves in either direction equally well, usually slowly as compared with the spirochetes, but not infrequently with considerable speed. The ends

may be either tapered or rounded. I have not been able to see the flagella which must be its means of locomotion, but I have seen refractile particles moving rapidly in little circling eddies in the fluid near fusiform bacilli trapped by débris. This is convincing, if indirect, proof of laterally placed flagella. Occasionally I have seen an organism of this general description with a narrow finlike process running spirally from one end to the other which appeared to be the means of locomotion, but such a structure is distinctly the exception rather than the rule. The body of the type I fusiform bacillus is usually not flexed during motion. Unlike the spirochetes, it often moves for a considerable time without resting. I have observed transverse division, a process which required as much as an hour for completion. There was no drawing out of the cellular substance into a long process during division.

The type II fusiform bacillus is shorter and narrower than type I, and it appears as a single line. Tapering at the ends is constant. It does not reflect the light so brightly, but it has the same kind of motion as type I. I have seen the type III fusiform bacillus somewhat less commonly than the other two types. It is still smaller (2 to 5 microns by 0.3 to 0.4 micron) and is nonmotile.

Belief in the biologic identity of specific oral spirochetes or spirilla with specific types of fusiform bacilli is based on certain recorded observations concerning the behavior of pure cultures of fusiform bacilli isolated from normal and diseased mouths, and of organisms isolated from the intestine which are morphologically like the oral spirochetes. Fusiform bacilli are prone to be markedly pleomorphic in culture. The type and degree of pleomorphism are greatly influenced by the age of the culture and by the addition of such an ingredient as sodium citrate or sodium hydroxide to the culture medium. Tunnicliff,[9] in the last of a series of papers on the cultural behavior of oral fusiform bacilli, reported that after one to two weeks of incubation actively motile spiral forms appeared and that these spiral forms developed from bodies which arose inside long filamentous forms of the original fusiform bacilli. In conclusion Tunnicliff stated: "These observations tend to confirm the theory that fusiform bacilli and spirilla are different forms in the life cycle of one organism." It is not clear which of the various oral spirochetes or spirilla are represented by the "spirilla" which appeared in the old cultures of these fusiform bacilli, and no accurately identifying data are given.

Sanarelli,[10] working with a pure culture of an anaeorbic intestinal spirochete morphologically similar to the larger oral spirochetes, found

9. Tunnicliff, R.: The Life Cycle of Bacillus Fusiformis, J. Infect. Dis. **33:** 147, 1923.

10. Sanarelli, G.: Origine commune des spirochètes et des bacilles fusiformes, Compt. rend. Soc. de biol. **96:**1136, 1927.

that changing the medium resulted in changing the spirochete to a fusiform bacillus. The change was reversible. The biologic identity of the two forms was established by specific agglutination tests. These observations have not been duplicated by other workers.

Fusiform bacilli are so entirely different from spirochetes, as observed in the living state under the dark field apparatus, that it is difficult to believe they are different forms of the same organism. The evidence suggesting such a relationship between specific fusiform bacilli and specific oral spirochetes is scanty and only moderately convincing. Cycles of bacterial life have often been suspected but seldom proved.[11] Spontaneous bacterial variation may produce relatively minor morphologic changes. The most marked variations in form are usually artificial or impressed, in the sense that they are induced by culturing. Certainly the burden of positive proof that specific fusiform bacilli and oral spirochetes are different forms of the same organism rests with those who contend that such a relationship exists. In the present state of knowledge, skepticism is justifiable. I have never observed any forms under the dark field microscope which appeared to be transitional.

Spirilla.—The spirillum most commonly seen, probably Spirillum sputigenum, is a short and crescent-shaped organism propelled haphazardly by flagella attached to the concave surface. Occasionally another organism of about the same size has been seen which corresponds with descriptions of Spirillum crassum. It is vaguely S-shaped and is propelled rapidly by a terminal flagellum of considerable length.

Vibriones.—Not infrequently one may find a field which is fairly loaded with small actively motile organisms which dart about with amazing speed. One cannot see what they are until the slide has stood for some time and the organisms have lost some of their vigor. Then they are seen to be tiny, curved or pear-shaped bodies and may be identified as vibrios. They are propelled by terminal flagella. The type usually found in the mouth is Vibrio viridans.

Other Organisms.—Besides the organisms mentioned one usually sees masses of bacteria and a few wandering phagocytes with cytoplasm full of dancing refractile granules. I have seen phagocytes engulf living fusiform bacilli and have watched the unsuccessful struggles of the latter to free themselves, but I have not observed living spirochetes undergoing phagocytosis. In about one half of the preparations of material from normal mouths there are more or less numerous ropes of what appear to be mycelia; these are occasionally septate but usually not.

Anaerobic Flora in the Mouths of Normal Children.—Since the literature does not contain satisfactory data concerning the frequency

11. Topley, W. W. C., and Wilson, G. S.: The Principles of Bacteriology and Immunity, ed. 2, Baltimore, William Wood & Company, 1936, pp. 26 and 199.

and the age distribution of the various types of anaerobic organisms in the mouths of normal children, an attempt was made to gather some data on this subject. Such information is obviously important in determining the relation of oral micro-organisms to acute infectious gingivostomatitis. Thirty-three healthy children between 9 months and 12 years of age were chosen at random. Of these, 12 were girls and 21 were boys. No child was accepted for study if there was any evidence of

TABLE 1.—*Qualitative and Quantitative Occurrence of Anaerobic Organisms in Dark Field Preparations and Stained Smears of Material from Mouths of Thirty-Three Normal Children*

		Spirochetes				Fusiform Bacilli					
Age	Sex	T. Microdentium	T. Macrodentium	T. Vincenti	T. Buccale	Type I	Type II	Type III	Spirilla	Vibrios	Stained Smear
9 mo.	M	0	0	0	0	0	2	0	0	0	—
9 mo.	M	0	0	0	0	3	3	3	0	1	—
12 mo.	F	0	0	0	0	2	3	2	1	1	—
1½ yr.	M	2	0	3	0	3	2	2	4	0	+
1½ yr.	F	3	0	3	0	3	3	0	3	0	+
1½ yr.	M	0	0	2	0	2	2	0	2	0	—
1 yr.	M	0	0	0	0	0	0	0	0	0	—
1 yr.	F	0	0	0	0	3	2	3	1	1	—
1¼ yr.	M	2	2	1	0	2	1	1	3	4	—
1 yr.	M	0	0	0	0	4	4	3	2	2	—
1 yr.	M	0	0	0	0	1	2	2	0	0	—
2 yr.	F	0	0	3	0	4	4	4	4	1	—
2 yr.	M	0	3	3	0	2	2	0	4	4	—
2 yr.	M	0	0	0	0	4	3	2	2	3	—
2 yr.	M	0	0	0	0	2	2	0	2	3	—
2 yr.	M	0	0	3	2	3	3	2	3	0	+
2 yr.	F	0	2	5	0	2	4	2	3	2	+
2 yr.	M	2	3	1	0	3	3	0	3	0	+
2 yr.	M	2	1	3	1	4	4	4	1	2	+
3 yr.	M	1	0	4	2	3	3	3	2	3	+
3 yr.	F	0	1	3	0	3	2	1	1	1	—
3 yr.	F	0	0	4	0	4	4	4	1	1	—
4 yr.	M	3	2	4	0	4	3	3	3	0	+
4 yr.	F	2	1	4	0	2	2	2	2	2	+
5 yr.	M	0	0	0	0	0	3	0	2	0	—
5 yr.	M	0	2	3	0	3	3	2	2	3	—
5 yr.	M	2	4	0	2	3	3	2	2	2	+
5 yr.	F	0	0	0	0	0	0	0	1	1	—
5 yr.	F	0	2	5	0	4	3	2	1	1	+
6 yr.	F	0	0	4	2	4	4	0	2	2	+
6 yr.	F	2	2	4	0	3	3	3	2	3	+
8 yr.	M	0	0	0	0	4	4	4	3	0	—
11 yr.	M	0	0	3	0	2	2	1	2	1	+
Positive, %		30	36	60	15	87	94	70	88	66	42

* The numbers have the following meaning: 1, occasional; 2, few; 3, moderate number; 4, great number; 5, enormous number.

present or past disease of the mouth or teeth. More explicitly, no child in this series had ever had soreness of the mouth, to the best of the mother's knowledge; he was not ill at the time of the examination; he had sound teeth; his gums throughout presented a glistening shell pink surface, and he had no visible inflammation of the lips, cheeks or tongue.

The gingivodental sulcus of two or three teeth in each child's mouth was scraped with the blunt end of a sterile wooden applicator. The material so obtained was transferred to a clean slide, covered with a

cover slip and examined under dark field illumination within thirty minutes. The cover slip was then removed, and the slide was fixed with heat, stained with a steaming 5 per cent aqueous solution of methylrosaniline (gentian violet) for five minutes and examined for spindles and spirals.[12]

The results of this study are shown in tables 1 and 2. Fusiform bacilli were present in nearly every mouth (94 per cent). Spirochetes were present in only 36 per cent of the preparations of material from children under 3 years of age but were found in 77 per cent of those from children over 3. The stained smears showed spindles and spirals in sufficient numbers to be considered positive[12] in 42 per cent of all cases. Thus the normal child's mouth at all ages beyond the first year usually harbors one or more different kinds of oral anaerobic organisms such as are commonly regarded as pathognomonic for acute infectious gingivostomatitis.

TABLE 2.—*Summary of Table 1*

		Spirochetes								Fusiform Bacilli										Positive Stained Smear	
		T. Mi.		T. Ma.		T. Vi.		T. Bu.		I		II		III		Spirilla		Vibrios			
Age	No. of Cases	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
9 mo.-2 yr.....	11	3	27	1	9	4	36	0	0	9	81	10	90	7	63	7	63	5	45	2	18
2-4 yr.....	11	3	27	5	45	9	81	3	27	11	100	11	100	8	72	11	100	9	81	5	45
4-11 yr.....	11	4	36	6	54	7	63	2	18	9	81	10	90	8	72	11	100	8	72	7	63
9 mo.-11 yr.....	33	10	30	12	36	20	60	5	15	29	87	31	94	23	70	29	88	22	66	14	42

Pathogenicity of the Oral Anaerobic Organisms.—There is no proof that the oral spirochetes, fusiform bacilli, spirilla or vibrios taken singly or in any combination are capable of initiating infection in man. The body of evidence indicates that these organisms live a commensal existence in the mouths of human beings and of some lower animals.

The spirochetes and fusiform bacilli that have been grown in pure culture have not been shown to be pathogenic for animals. Certain spirilla die out when injected into animals but give rise to toxic symptoms suggesting the presence of an endotoxin. Vibrios may produce at the site of injection indurated lesions, which gradually disappear without softening. Massive injections of vibrios into guinea pigs cause death without gross lesions. Various combinations of spirochetes, fusiform bacilli, spirilla and vibrios have been injected in large quantities into

12. The term "spindles and spirals" is used by the staff of the hospital's laboratory of general bacteriology in reporting the results of stained smears. A positive smear is one in which both spindles (fusiform bacilli) and spirals (presumably spirochetes) are at least fairly numerous. A negative smear is one in which either spindles or spirals or both are scarce. Spirals are much more commonly absent or present only in small numbers than are spindles.

animals without producing anything more than small abscesses.[13] In short, animal experimentation indicates that the oral anaerobes have practically no individual or group pathogenicity.

Material taken directly from the throat of a patient with Vincent's angina will produce foul, necrotic subcutaneous abscesses or pulmonary gangrene in laboratory animals.[13] Material from these experimental lesions will infect other animals in series. Cultures of the original material show, in addition to the oral anaerobes so far discussed, streptococci or staphylococci. When injected into animals in pure culture the streptococci produce cellulitis, which may be fatal; the staphylococci produce abscesses. With a mixture of pure cultures of T. microdentium, V. viridans, a small fusiform bacillus and an anaerobic hemolytic streptococcus, Smith [13] has been successful in producing foul necrotic abscesses and pulmonary suppuration in laboratory animals. Again it appears probable that the true pathogen of the mixture was the hemolytic streptococcus. There are no reports of similar experiments with material from patients with acute infectious gingivostomatitis.

The pathogenic properties of material from fusospirochetal sources which is capable of producing necrotic lesions in animals may perhaps be explained as follows: The streptococcus or staphylococcus initiates invasion of the tissue and multiplies in situ, establishing itself as both virulent and pathogenic. The tissue is so changed as a result of the presence of the cocci that the oral anaerobes are able to survive, and with the development of the first area of necrosis growth of the anaerobes accelerates. Necrotic tissue favors their growth and multiplication, as shown by Lichtenberg [14] and his co-workers. Perhaps as a result of the life processes of the oral anaerobes, substances are formed in dead tissue which are toxic to surrounding living tissue. However this may be, the fully developed lesion is different from what it would have been had not the oral anaerobes accompanied the pathogenic cocci. It is not improbable that in rare cases of disease in human beings, particularly noma and heavy metal poisoning, local resistance of the tissues is so far lowered that the oral anaerobes actually invade living tissue. The experiments of Wallace [15] indicated that scillaren-B in large doses renders the tissues of the dog's mouth vulnerable to invasion by the oral anaerobes previously present.

13. Smith, D. T.: Fusospirochetal Disease of the Lungs Produced with Cultures from Vincent's Angina, J. Infect. Dis. **46**:303, 1930.

14. Lichtenberg, H. H.; Werner, M., and Lueck, E. V.: The Pathogenicity of the Fusiform Bacillus and Spirillum of Plaut-Vincent, J. A. M. A. **100**: 707 (March 11) 1933.

15. Wallace, H.; Wallace, E. W., and Robertson, O.: Production of Experimental Plaut-Vincent's Angina in the Dog. J. Clin. Investigation **12**:909, 1933.

There is no well established evidence with which this view conflicts. By relegating the oral anaerobic organisms to a position subordinate to that of the established pathogens with which they have been shown to be associated during the course of clinical disease, one introduces a change of emphasis which clarifies and simplifies certain aspects of this type of infection.

Brennemann [16] also expressed skepticism concerning the pathogenic properties so commonly attributed to the oral anaerobes. It was at his suggestion that Lichtenberg, Werner and Lueck made a clincal and experimental investigation of the pathogenicity of the "fusiform bacillus and spirillum of Plaut-Vincent." [14] On the experimental side they were able to show that during healing of simple traumatic abrasions produced in the mouths of guinea pigs fusiform bacilli and spirilla were present on the surface of the lesion and that neither injections of sulfarsphenamine nor local application of the drug affected either the presence of the organisms or the healing of the lesions. Similarly, in 91 per cent of 108 children they found the same types of organisms in the membrane which forms in the tonsillar fossa during healing after tonsillectomy. Clinically they observed 16 cases of acute infectious gingivostomatitis in which no treatment was given and found that in all the condition healed spontaneously in a few days.

Smith stated in the first page of his monograph on fusospirochetal disease [8] that the oral spirochetes "are really 'opportunists', rather than primary pathogens like T. pallidum." But he went on immediately to say that "when once they [the oral spirochetes] have gained a foothold, in symbiosis with their associated anaerobes, they produce a destructive lesion . . . ." Smith is the most eminent exponent in this country of the disease-producing properties of fusospirochetal organisms. In the conclusion of a paper in which he took issue with the skepticism of Lichtenberg and his associates, Smith [17] stated:

> If one can consider a group of anaerobic organisms acting in symbiosis as a single entity, Koch's postulates have been fulfilled: (a) The fusospirochetal organisms are constantly present in the lesions; (b) they have been isolated in pure culture; (c) when recombined and injected into animals, they produced the typical disease; (d) they have been isolated from the experimental lesions; (e) up to the present, the typical disease has not been produced by any other organism or any other combination of organisms.

This statement applies only to a particular form of pulmonary suppuration, and the term fusospirochetal organisms as used by Smith includes a pathogenic anaerobic hemolytic streptococcus.

16. Brennemann, J.: Oral Sepsis in Childhood, J. Am. Dent. A. **23**:1817, 1936.

17. Smith, D. T.: Should Fusospirochetal Infections Be Treated with Arsenicals? Arch. Otolaryng. **18**: 760 (Dec.) 1933.

ETIOLOGY

Acute infectious gingivostomatitis is a well defined clinical entity. Although the primary etiologic factor has not yet been established, it is probable that most if not all attacks are initiated by a single cause. The correct theory of the etiology and pathogenesis of this disease should explain (1) the greater frequency in females, (2) the striking age incidence, (3) the rarity of second attacks, (4) the strong tendency toward spontaneous cure, (5) the sporadic and epidemic occurrence, (6) the lack of any apparent relation of sporadic cases to general health or to disease, either concurrent or antecedent, (7) the development of a severe degree of gingivitis, aphthae of the mucous membrane, labial and lingual lesions and nonsuppurative regional lymphadenopathy, (8) the presence of oral anaerobes in great numbers and (9) the frequent occurrence of constitutional before local symptoms.

Predisposing Causes.—No important predisposing causes were discovered in the present series of cases. The general health of the children before the disease developed was good except in 4 cases, in which the general condition of the child was poor. Not infrequently the disease occurred in children of unusually good general health. Similarly, in only 4 cases was there a noteworthy local abnormality of the mouth, such as dental caries or a condition resulting from poor oral care. Teething bore no relation to the disease. The gingivitis in 1 instance (case 49) started where a tooth had recently been lost.

There was no evidence whatsoever that diet played any part in predisposition to or cause of the disease. All of the children took milk and fresh vegetables nearly every day. Practically all of the younger children took orange juice or tomato juice every day. None of the children had scurvy, pellagra or active rickets. Only 1 child had a history of scurvy (case 48). All of the children recovered and had no recurrence of the disease without any change in the usual diet. When the duration of the condition in 9 of Gerstenberger's [18] 13 cases which were typical examples of acute infectious gingivostomatitis is compared with the total duration curve of the present series, it is apparent that the treatment with large doses of the vitamin B complex (yeast tablets) caused no significant diminution in the average duration of the disease.

Exciting Causes.—In view of the common occurrence, sometimes in great numbers, of oral anaerobic organisms in the mouths of normal children, it would seem unlikely that these bacteria, which have not been shown experimentally to be pathogenic, are the primary cause of a disease which begins suddenly, often with constitutional symptoms preceding the appearance of local lesions, which runs a self-limited course

18. Gerstenberger, H. J.: The Etiology and Treatment of Herpetic (Aphthous and Aphtho-ulcerative) Stomatitis and Herpes Labialis, Am. J. Dis. Child. **26**:309 (Oct.) 1923.

to complete cure and which is seldom followed by a second attack. It has not been shown that the oral anaerobes are able to produce the shallow, superficial oral lesions so commonly associated with acute infectious gingivostomatitis. If these organisms are to be accepted as the primary etiologic agents, either they must be credited with marked fluctuations of virulence or it must be assumed that for some unestablished reason children, especially little girls, are sometimes susceptible to infection with the oral anaerobes and that this infection usually results in the development of lasting immunity. It is perhaps possible, but in my opinion highly improbable, that this explanation of the cause of the disease is correct.

A second and more plausible etiologic theory is that the primary cause is a streptococcus or staphylococcus. These are the only organisms in material taken from fusospirochetal sources which have been shown in animal experiments to have individual pathogenicity. More data are needed to show how constantly aerobic or anaerobic pyogenic cocci are present in the lesions of this disease. The theory just cited harmonizes with most of the cardinal clinical features, but it does not appear to be an entirely adequate explanation either of the sex and age incidence or of the rarity of second attacks. Furthermore, it is unlike the usual activities of the pathogenic cocci to cause fever for several days before local lesions develop. Assuming for the moment that the pathogenic cocci are the primary cause in at least some of the cases, it would follow that the oral anaerobes, already present before the disease appeared, increase in numbers in the anaerobic crevices between the teeth and gums, producing the oral fetor and contributing to the severity and perhaps to the duration of the gingivitis.

A third etiologic possibility is that the primary cause is a filtrable virus. There is a present day tendency toward much speculation concerning the role of the filtrable viruses in diseases of obscure etiology. There is no direct evidence either for or against the theory that a filtrable virus is the cause of acute infectious gingivostomatitis. It is merely a possible explanation, which awaits investigation.[19]

19. Subsequent to the preparation of this paper a report of considerable interest has appeared (Dodd, K.; Johnston, L. M., and Buddingh, G. J.: Herpetic Stomatitis, J. Pediat. **12**:95, 1938). These workers found in a small series of cases of acute infectious gingivostomatitis that material from the oral lesions caused a severe purulent type of keratoconjunctivitis when inoculated into the scarified cornea of the rabbit. Some weeks after these animals had recovered it was not possible to infect the opposite cornea with a known virulent strain of herpes simplex virus. Thus the herpes virus or some immunologically similar agent was apparently present in the material from the original lesions. Although scarcely affording complete proof of an etiologic relationship between the virus of herpes simplex and acute infectious gingivostomatitis (Rivers, T. M.: Viruses and Koch's Postulates, J. Bact. **33**:1, 1937), these findings may constitute the first in a series of steps which may eventually prove this disease to be caused by a filtrable virus.

Whatever the primary exciting cause or causes may be, there can be no doubt that acute infectious gingivostomatitis favors the growth and multiplication of the anaerobic organisms of the mouth. They are probably the principal cause of the foul odor of the lesions and may contribute to the inflammation of the gums. In rare instances, when extensive necrosis and gangrene develop, the oral anaerobes may actually invade the tissues. Necrotic and gangrenous extensions are most to be feared when acute stomatitis occurs concurrently with or immediately after measles or typhoid fever. Ordinarily, in cases of acute infectious gingivostomatitis the oral anaerobes are probably nothing more than opportunist secondary invaders which are incapable of continuing disease of the tissue once the body has successfully defended itself against the primary etiologic agent.

PATHOLOGY

There are no reports of the histopathologic picture of acute infectious gingivostomatitis. This is not remarkable, considering the benign nature of the disease. Observations of the gross visible changes in the tissues of the mouth will be described in a subsequent section. In his monograph on necrotic gingivitis Box [1] included photomicrographs and verbal descriptions of histopathologic changes, in which he laid great emphasis on ulceration and necrosis. Unfortunately he neither stated the sources of his material nor gave case histories, and from the brief clinical descriptions one cannot be sure he was describing acute infectious gingivostomatitis.

INCIDENCE

It is fair to say that at the clinics in which material for the present study was assembled acute infectious gingivostomatitis occurs four or five times as often as all other specific types of acute stomatitis in infants and older children combined. Thrush and aphthous stomatitis come next in frequency. Bednar's aphthae is uncommon, and for several years in not a single case has herpetic stomatitis, perlèche, gonococcic stomatitis, diphtheritic stomatitis, noma or stomatitis with deep ulceration been seen. Similarly, acute infectious gingivostomatitis is much more common than any one of the other acute so-called fusospirochetal diseases (acute putrid pulmonary suppuration, Vincent's angina, noma, gangrenous balanitis, etc.); indeed it is actually more common than all of them combined.

The occurrence of acute infectious gingivostomatitis does not seem to bear any relation to the previous condition of the child's general health. With Kerley [20] I should say: "Strong vigorous children are as susceptible to the disease as are the rachitic, the badly fed, or the gener-

20. Kerley, C. G.: Practice of Pediatrics, ed. 2, Philadelphia, W. B. Saunders Company, 1918, p. 163.

ally delicate." The disease is by no means limited to the poorer classes. Kerley also remarked on observing "many cases among the well to do."

Seasonal Incidence.—In a series of 30 consecutive cases seen over a two year period in San Francisco there was a fairly striking seasonal incidence (chart 1 *A*), but the number of cases was not great enough to establish a stable curve. In 15 cases (50 per cent) the disease occurred in the four months from October to January and in only 5 cases (17 per cent) in the four months from March to June. Thus incidence of the disease appears to be most frequent in the late fall and

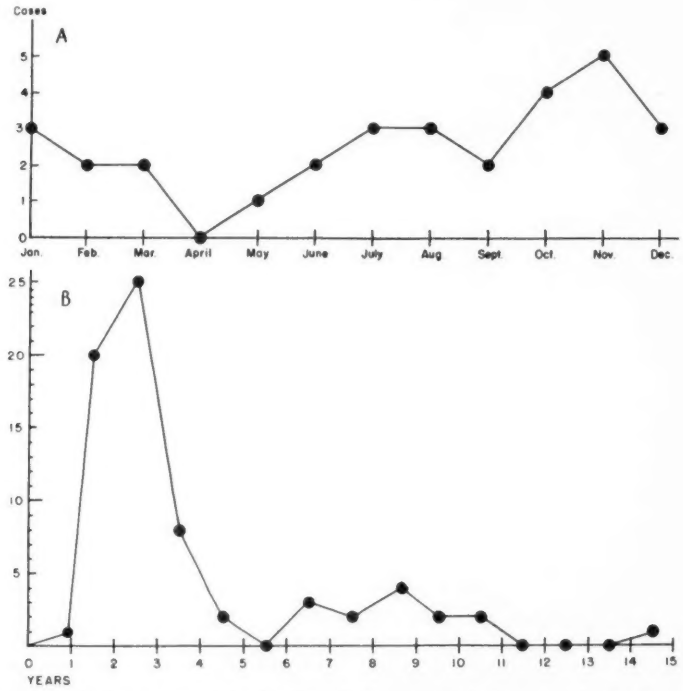

Chart 1.—*A*, the seasonal incidence of 30 consecutive cases of gingivostomatitis which occurred in San Francisco between September 1934 and September 1936. *B*, the age incidence in all cases of the present series (69 cases).

early winter, and least frequent in the spring and early summer in the locality in which these cases were observed.

Age Incidence.—One of the most striking features of acute infectious gingivostomatitis is the age incidence (chart 1 *B*). The youngest patient in the present series was a Negro girl 11 months old, who contracted the disease from an older sibling, probably through frequent kissing (case 52). In two thirds of all the cases the disease occurred before the third birthday and in three fourths before the fourth birthday. In a little more than one third of all the cases the condition occurred in

children 2 years old, i. e., in the third year of life. The disease was more strikingly confined to younger children in San Francisco, where in 84 per cent of the 43 cases it occurred before the fourth birthday, than in Philadelphia, where in 65 per cent of the 26 cases it occurred in the same age period. Judging from the number of cases observed in the adult medical clinic service at Stanford University Hospital in San Francisco, where a similar condition occurs in not more than 2 or 3 cases each year, the disease is much less common in adults than it is even in older children.

Sex Incidence.—Seventy per cent of the patients in San Francisco and 58 per cent of those in Philadelphia were girls. In the entire series of cases, 45 (65 per cent) of the patients were girls and 24 (35 per cent) boys. The ratio was the same for the 13 children 5 or more years old, of whom 8 were girls and 5 were boys. Thus it appears that girls at any age are about twice as commonly affected as boys. I have no explanation to offer for this curious fact. Of the other acute infectious diseases, excluding gonococcic vaginitis, pneumococcic peritonitis is the only one with which I am familiar which has a predilection for girls. Most infectious diseases of young children affect the two sexes about equally.

Communicability.—In only 7 (10 per cent) of the cases in the present series was there a history of exposure. In 5 of the 7 cases the disease occurred after exposure to a sibling. In the other 2 instances the child was exposed to an adult member of the household. The duration of the exposure before the development of the first evidences of illness, which could be determined in only 5 of the 7 cases, was found to be three, four, five, seven and eleven days, respectively. In all of these cases the exposure was continuous up to the time the disease developed in the second case. I therefore can say of the incubation period only that apparently it may be as short as three days. In many cases siblings giving no history of this disease were intimately exposed in the home and escaped infection. Most children seem to be rather insusceptible.

NATURAL HISTORY

Prodromal Stage.—The first symptoms of acute infectious gingivostomatitis may be local or constitutional or both. As to the frequency of the various modes of onset in this series, the earliest symptoms were fever alone in 32 cases, or 46 per cent of the series; fever and local pain in 21 cases, or 31 per cent, and local pain alone in 16 cases, or 23 per cent. Thus in nearly half of the cases fever alone was the first symptom, and in more than three quarters of the cases fever, with or without local symptoms, initiated the disease. These figures are based to a large extent on the history. Care was taken to determine the

earliest evidences of indisposition in every case, but leading questions were not asked. In those cases in which fever alone was the first symptom there was an interval of from twelve hours to four days before oral symptoms appeared. Chart 2 *A* shows the duration of fever

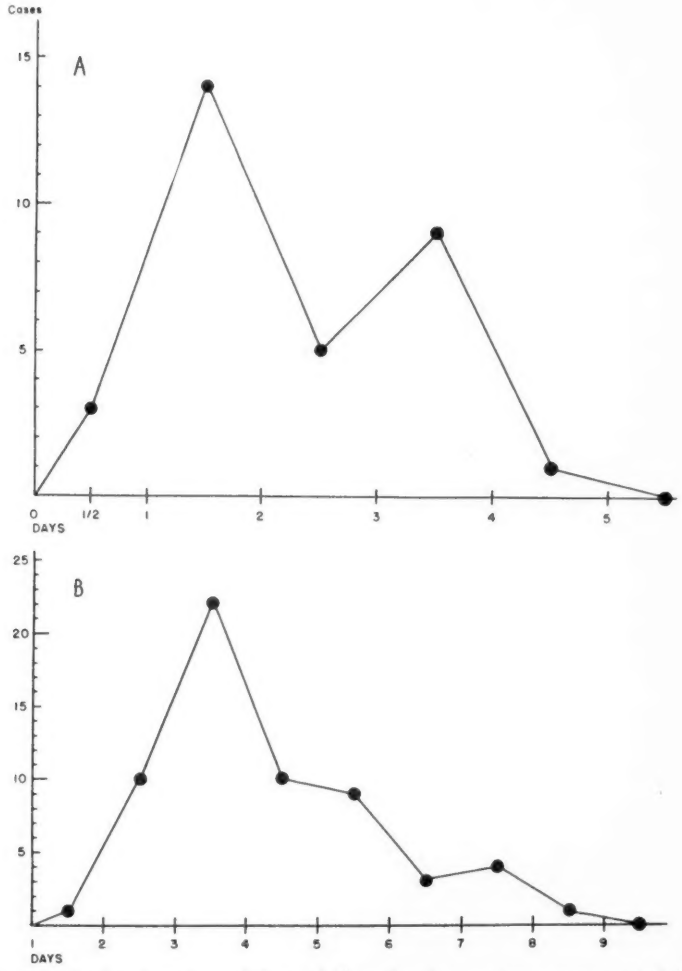

Chart 2.—*A*, the duration of fever before local symptoms were noted in those cases (32) in which fever was the first symptom. *B*, the entire duration of fever in the cases (62) in which there was fever.

before local symptoms appeared in the 32 cases in which the onset occurred with fever alone.

Constitutional Symptoms.—Because in most cases acute infectious gingivostomatitis occurs in children too young to describe subjective sensations accurately, only the objective evidences of ill health can be

appraised. Fever, the most constant constitutional symptom, occurs early in the course of the disease; it sometimes exceeds 40 C. (104 F.) and often reaches 38.5 C. or 39 C. (101.3 or 102.2 F.) but seldom lasts more than five days. It is usually gone by the time the oral lesions are reaching the height of severity. In 36 cases (52 per cent) proof of fever was obtained by thermometer; in 26 cases (38 per cent) it was supplied only by the history. Thus fever was probably present in 62 cases (90 per cent). Chart *2 B* shows the duration of fever in the 62 febrile patients. In only 8 cases (12 per cent) did the fever last more than five days. The occurrence and duration of fever are related to the severity of the involvement but not to the age of the patient, since 70 per cent of the patients who had fever for more than three days had not reached the fourth birthday, whereas 76 per cent of all the patients became ill before the fourth birthday. In one instance (case 9) a chill and in another (case 69) a convulsion accompanied the onset of fever. In case 27 a series of four convulsions occurred during a febrile period of three or four days.

Other constitutional symptoms were anorexia, listlessness, restlessness and irritability. Such symptoms are, of course, common to various febrile states. In the course of acute infectious gingivostomatitis, anorexia and listlessness are often noted during the febrile period before the appearance of oral signs or symptoms. Restlessness and irritability usually accompany the development of lesions in the mouth and correspond with the amount of pain caused by the lesions. In none of the patients was marked prostration present. Even with high fever the absence of depression and weakness was conspicuous.

Local Signs and Symptoms.—Soreness of the mouth, which was noted at the onset in only 23 cases, usually begins rather abruptly and becomes increasingly severe for several days. Often by the time the oral lesions are most extensive and intense the general condition has begun to improve; the child is more alert, often is afebrile and will take nonirritating fluid nourishment with some interest. Unfortunately it is usually not until about this time that the child is first brought to the physician; for this reason the earliest changes in the tissues of the mouth were not often observed in the present series. Case 14, that of a white girl 3 years old, was of particular interest in this respect. She was admitted to the hospital before any noticeable lesions had appeared in her mouth. The temperature on her admission was 40 C. (104 F.). Within fifteen hours after admission a number of small white ulcers had appeared on the buccal mucous membrane, and the gums had become definitely red and swollen. The child had complained of soreness of the mouth the day before admission, nearly two days before local lesions were seen. This case illustrates the rapid and simultaneous development

of the two types of oral lesion in this disease: the gingivitis and the small white ulcers.

Gingivitis is the most constant and obvious lesion of the disease. It was present in every case. With few exceptions the gums around all of the teeth are involved. The first change is a marked hyperemia, which transforms the shell pink color of the normal gum to a dark dusky red or purple. The gum then swells and seems to become loosened from the tooth. This "loosening" is more apparent than real, for to a large extent it is the result of extension of the swollen gum toward the crown of the tooth. The interdental tongues of gingival tissue often extend nearly to the margin of the tooth. Older children not infrequently say during the height of the gingival involvement that their teeth seem to have lost feeling, giving a dull or numb sensation when the jaws are closed tightly. This is probably indicative of impaired sensation in the pericementum. Normal gums are strikingly insensitive. In sharp contrast is the exquisite tenderness of the inflamed gums associated with this disease. The gums bleed easily and sometimes spontaneously. Occasionally generalized bleeding of the gums occurs simply from the congestion and increase of venous pressure incident to crying. There is an accumulation of sticky clear mucoid material in the crevices between the gums and the teeth; this has a foul odor, readily appreciated when some of it is transferred to a slide and held close to the nose. Marginal ulceration of the gums occurred in only 20 per cent of the cases. In no case did gingival ulceration lead to any appreciable destruction of tissue. Marginal ulceration consists of a narrow gray line of exudate along the edge of the swollen gum. It is not improbable that superficial ulceration frequently extends down between the teeth and the gums in these hidden recesses.

Small round ulcers were seen in some part of the mouth in 44 (64 per cent) of the cases. Neither by means of inspection nor in any other way can these ulcers be distinguished from the lesions of aphthous stomatitis. The tongue was affected with small ulcers in 31 cases, the lips in 21 cases, the buccal mucous membrane in 10 cases and the tonsils in 7 cases. Less commonly the soft palate or the gums themselves exhibited lesions of this sort. In every instance the ulcers were small and extremely shallow. They tend to occur in successive crops. On the tongue these lesions may affect the tip, lateral edges or dorsal aspect; they consist merely of small nondescript gray spots, often with narrow red areolas. Gentle rubbing does not remove the gray material or cause bleeding, but it excites strong objection from the child. The ulcers are extremely tender. The larger of the lingual ulcers may have irregular margins; but those that occur inside the lips of the buccal mucous membrane or on the soft palate nearly always have smooth margins. They are round or oval and from 1.5 to 3 mm. across. They do

not glisten, which indicates that the surface epithelium has been destroyed, leaving a grayish white base. When the lesion is palpated with the bare finger one gains the impression that it is elevated rather than depressed. The surface of the lesion is actually very slightly depressed, but beneath the surface there is some induration, which, as it does not yield readily under the palpating finger, makes the whole lesion seem more prominent than the adjacent tissues. The grayish white material on the surface is not easily rubbed away. Vigorous scraping causes bleeding. I have not observed a vesicular stage in the development of the ulcers. Each lesion runs its course from first appearance to complete cure in about four days. I have observed small indurated lesions of the vermilion border of the lips, which definitely began beneath the epithelium and subsequently eroded through the surface.

It is true that in 10 per cent of the cases the patients showed little white ulcers of the tonsils, but these lesions were in no wise different from the ulcers which occurred in the anterior part of the mouth. Usually they healed while the gingivitis was still marked.[21] In no instance, with the possible exception of case 7, did the involvement of the tonsils or pharynx appear to be the principal focus of the disease, and in three quarters of all cases that part of the oral cavity which lies behind the anterior pillars exhibited no noteworthy changes. In this respect my experience was different from that of Brennemann,[16] who stated:

> . . . I have seen literally hundreds of cases of acute gingivitis and stomatitis showing swollen, bleeding, painful gums and gingival and buccal ulceration, in practically every instance easily interpreted as an extension, or at least an accompaniment, of a very evident infection in the throat. These children are sick, have a fever that is often high . . .

The odor of the breath of children suffering from acute infectious gingivostomatitis is characteristic and useful in diagnosis. Odors are not susceptible of accurate description. Bloomfield [22] has well described this smell in saying: "The breath has the peculiar, typical, stinking odor associated with lesions in which putrefactive anaerobes are present. Once familiar with this smell, one never forgets it." The breath in 46 cases reported here (67 per cent) had this foul odor to a striking degree. The odor disappears with resolution of the stomatitis. The cause of the odor cannot be stated with absolute certainty, but there is reason to believe it is related to the presence of certain of the oral anaerobes. Smith [8] stated that pure cultures of T. microdentium have a foul odor;

21. In another 10 per cent (7 cases) the tonsils were inflamed, and in 3 other cases (5 per cent) the pharynx was hyperemic.

22. Bloomfield, A., in Christian, H. A.: Oxford Medicine, New York, Oxford University Press, 1921, vol. 5, chap. IA, p. 10 (1).

T. buccale, an odor suggesting rancid butter; the type I fusiform bacillus, a disagreeable, slightly rancid odor, and the type III fusiform bacillus, a faint rancid odor. Because dark field examinations were done in only a small percentage of the cases in the present series, no correlation could be made between odor and the presence or absence of the individual oral anaerobes.

Swelling of the regional lymph nodes was second in frequency to gingivitis in the present series. Sixty-three patients (91 per cent) had enlargement of the submaxillary lymph nodes. It is important to palpate under the mandible, as well as at the angles of the jaw, where usually ten or more distinct, firm, only slightly tender lymph nodes can be felt. Only rarely was lymphadenopathy marked enough to be mentioned in the history or to be noticeable on inspection. Often the lymph nodes were still palpable after all other lesions of the disease had healed. In no case did the lymph nodes swell alarmingly or suppurate.

TABLE 3.—*Incidence of Signs and Symptoms*

Sign or Symptom	No. of Cases	Percentage
Gingivitis	69	100
Regional lymphadenopathy	63	91
Fever (including probable and proved)	62	90
Odor	46	67
Round ulcers	44	64
Proved fever	36	52
Glossitis	31	45
Lesions of lip	21	30
Tonsillar involvement	14	20
Linear gingival ulcers	14	20
Buccal lesions	10	14
Other signs or symptoms	12	17

During the days when the stomatitis is at its worst the child is miserable. The lips are swollen and parted. Salivation is often profuse and sometimes leads to excoriation of the lower lip. Solid food is refused, but liquids are usually taken in amounts sufficient to prevent acute dehydration. Fear of pain incites crying whenever the doctor or nurse appears. The child is irritable and sleeps fitfully. In none of the cases was there diarrhea and in only 1 case vomiting. Table 3 shows the frequency of the principal signs and symptoms of this disease.

Resolution.—The gingivitis usually outlives the little white ulcers by several days. The gingival swelling sometimes diminishes with startling rapidity, but it may be moderately protracted. Diminution in the amount of pain and tenderness often precedes visible oral changes by a day or two. Hyperemia of the margins of the gums is the last stage in gingival resolution. The tendency to bleed decreases, but it often continues in a minor degree until resolution is complete. Once healed, the gums look entirely normal, and the sites of the little white ulcers can rarely be identified.

A constant feature of the course of the disease is the absence of exacerbations and remissions. The extent and severity of the lesions progress steadily or intermittently toward a fastigium. After a time improvement begins; this likewise may be steady or intermittent. Once improvement has begun one need not fear further extension of the disease process. Individual variation in course lies largely in the rate of evolution and resolution.

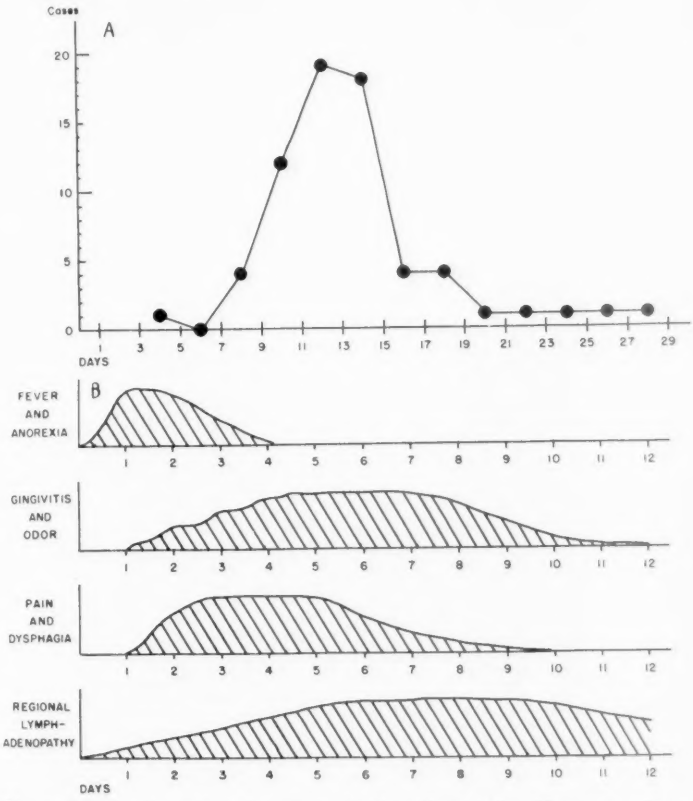

Chart 3.—*A*, the total duration of the disease in 67 cases. *B*, a schematic representation of the duration and the intensity of various symptoms and signs.

Total Duration.—Chart 3 *A* indicates the total duration of the disease in 67 cases of the series. As will be shown in the discussion of treatment, the injections of sulfarsphenamine given in alternate cases did not have any demonstrable effect on total duration; the curve may therefore be taken as representative of the natural duration of the course of acute infectious gingivostomatitis for which the patients receive essentially only symptomatic treatment combined with simple nonspecific local care. It is important to bear in mind that by the term "total duration" is meant the lapse of time between the first indication of

indisposition and the disappearance of all visible evidences of the disease. These rigid and exacting criteria revealed a slightly longer total duration than has been reported by some other authors.[23] The difference is, I think, more apparent than real. As nearly as I can estimate from Lichtenberg's [14] 7 case reports, the average total duration of the disease in his cases was eleven days. Similarly, in the 9 of Gerstenberger's [18] 13 cases, which apparently were typical instances of acute infectious gingivostomatitis, the average total duration was about eleven

TABLE 4.—*Degree of Involvement in Patients With and Without Ulcers*

Severity	Round Ulcers		No Ulcers	
	Number	Percentage	Number	Percentage
Mild	3	7	4	17
Moderate	32	72	18	71
Severe	9	21	1	4
Atypical	0	0	2	8
	44	100	25	100

TABLE 5.—*Occurrence of Fever in Patients With and Without Ulcers*

Fever	Round Ulcers		No Ulcers	
	Number	Percentage	Number	Percentage
Proved	30	71	7	28
Probable	10	24	14	56
None	0	0	4	16
Not recorded	2	5	0	0

TABLE 6.—*Type of Onset in Patients With and Without Ulcers*

Onset	Round Ulcers		No Ulcers	
	Number	Percentage	Number	Percentage
Fever	24	56	8	32
Local involvement	8	16	8	32
Both	12	28	9	36
	44	100	25	100

days. The average duration in 62 of the 67 cases in the present series, in which the range was from five to nineteen days, was twelve days, and the average duration for the entire series was 12.7 days. In 5 cases (cases 45, 48, 57, 60 and 64) the total duration ranged between twenty and twenty-eight days, usually because of a mild, low grade gingivitis which was slow to heal completely.

The usual time relations of some of the principal signs and symptoms are graphically indicated in chart 3 *B*.

Comparison of Clinical Findings in Patients With and Without Round Ulcers.—When the clinical features in the 44 cases in which

23. Lichtenberg and others.[14] Gerstenberger.[18]

round ulcers occurred are compared with those in the remaining 25 cases, many similarities and a few important differences, which are, however, quantitative rather than qualitative, become apparent. Of the patients with ulcers proportionately more had severe and fewer had mild involvement (table 4); in this group fever, both proved and probable, was more constant (table 5).

The average length of illness was 12.36 days for the patients with ulcers and 13.25 days for the others. Total duration curves (chart 4 *A*)

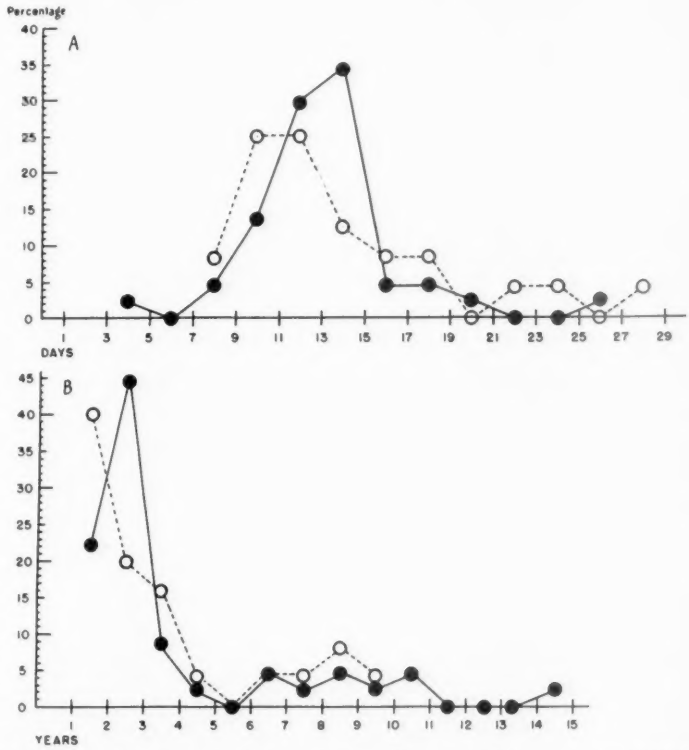

Chart 4.—*A*, the total duration of the disease in 44 cases in which ulcers developed (solid line) and in 25 cases in which none occurred (dotted line). *B*, the age incidence in the same cases.

show a greater spread in the group without ulcers; i. e., the duration of illness in patients with ulcers was somewhat more uniform. Thus patients with ulcers tended to have more severe involvement, were more commonly febrile, had a somewhat more uniform total duration of illness and recovered one day sooner, on the average, than those patients in whom ulcers were not seen.

In patients who have ulcers with the disease, onset is twice as likely to occur with fever alone as in patients who have no ulcers (table 6).

However, the most striking and significant dissimilarity between the two groups of patients was found in sex incidence. The incidence of ulcerous involvement was approximately equal in the two sexes. There were 20 boys and 24 girls. In the nonulcerous group, girls were affected five times as frequently as boys, this group containing 21 girls and only 4 boys. A less striking difference may be noted in the age incidence of the two groups (chart 4 *B*). A sharp peak of frequency occurred in the second year of life in the nonulcerous patients, who were twice as numerous in that period as ulcerous patients. Exactly the opposite relation held for the third year, when patients with ulcers were twice as numerous as those without. The two curves of age frequency were parallel in older children.

The marked difference in the sex incidence of the two groups may suggest a dual causation, but it may just as well indicate merely that in girls ulcers are less prone to develop than in boys. Until the true significance of this difference is discovered there is no advantage in making a sharp clinical differentiation between the two groups, for in other respects similarities were marked and constant.

Relation of Aphthous Stomatitis to Acute Infectious Gingivostomatitis.—It is not improbable that aphthous stomatitis and acute infectious gingivostomatitis have the same, as yet unidentified, primary cause. In support of the possibility of this relation are the age incidence, the frequent early constitutional symptoms, the type of lesions often seen, the regional adenopathy, the tendency toward spontaneous cure, the infrequency of second attacks and the sporadic and epidemic occurrence. The principal objection to this theory is that I observed round aphthous ulcers in only 64 per cent of my cases, and it is only by the presence of these typical lesions that aphthous stomatitis can be identified. There is no other diagnostic criterion. It is not possible to distinguish by inspection alone between the round ulcers of aphthous stomatitis and those which commonly occur in cases of acute infectious gingivostomatitis. In the case of the 1 patient with aphthous stomatitis without gingival involvement whom I have recently observed, dark field examinations of material from the gingivodental sulcus revealed no oral anaerobes. Further observations consistently giving the same results would constitute important support of the hypothesis that aphthous stomatitis occurring in a mouth infested with oral anaerobes gives the clinical picture of acute infectious gingivostomatitis, whereas the same disease occurring in a patient whose mouth is free from oral anaerobes may present a more or less pure picture of aphthous stomatitis. That the combined presence in great numbers of spindles and spirals, as seen in the stained smear, is certainly not essential for the development of gingivitis is shown by those of my cases in which there were one or more negative gingival smears.

Fischl,[24] who wrote the section on the diseases of the oral cavity in Pfaundler and Schlossmann's "The Diseases of Children," considered severe gingivitis and oral fetor as characteristic and common features of aphthous stomatitis. He stated: "The participation of the mucosa of the gums in this affection is not sufficiently stressed." Those of my cases in which there were aphthous ulcers, some 64 per cent of the series, were obviously typical examples of aphthous stomatitis according to Fischl's classification. Similarly, 9 of the 13 cases of "herpetic (aphthous and aphtho-ulcerative) stomatitis" described by Gerstenberger [18] were typical examples of what I prefer to call acute infectious gingivostomatitis.

Complications and Recurrences.—In none of the cases were there any serious complications. In a few thumb suckers and nail biters paronychias developed. In lip suckers widespread excoriation of the lips may develop. There were no instances of large membranous lesions of the tonsils such as occur in Vincent's angina, and in no instance was the lung involved. Purulent otitis media and conjunctivitis did not occur. One child (case 16) had two periapical abscesses at the sites of badly carious teeth. One boy and 1 girl had mild transient urethral inflammation.

Not 1 patient of this series is known to have had a recurrence of the disease. Only 1 child (case 28) gave a history of a previous attack, and this child had more extensive dental caries than any other patient in the series.

LABORATORY DATA

Gingival Smears.—One or more stained gingival smears were examined for spindles and spirals [12] in 60 of the 69 cases, with the results shown in table 7.

TABLE 7.—*Results of Gingival Smears in Sixty Cases*

Results	No. of Cases	Percentage
Positive	48	80
Negative, later positive	3	5
Total positive	51	85
Negative	9	15

The technic of obtaining material for smears is of some importance if a maximum number of positive results is to be obtained. A cotton swab is definitely inferior to the blunt end of a wooden applicator or a toothpick. Material should be obtained from the gingivodental sulcus, where one often finds a small amount of clear tenacious glairy material containing great numbers of oral anaerobes. After fixation by heat the

24. Fischl, in von Pfaundler, M., and Schlossmann, A.: The Diseases of Children, translated by M. G. Peterman, Philadelphia, J. B. Lippincott Company, 1935, vol. 4, p. 11.

slide should be stained for at least five minutes in a hot 5 per cent aqueous solution of methylrosaniline (gentian violet). The slide may be flooded with the dye and heated from below. One should not depend on stained smears for diagnosis. Positive smears are frequently found in unrelated types of oral inflammation or even in smears from "normal" mouths.[14] Dark field examinations give far more specific information concerning the relative numbers and kinds of organisms than can be obtained from stained smears.

The stained smear and dark field examinations of case 69 are worthy of special emphasis. The clinical picture was entirely typical. Two careful dark field examinations were made, one on the seventh and one on the ninth day of illness. In the first preparation only an occasional spirochete was seen, but there were moderate numbers of fusiform

TABLE 8.—*Data on the Blood of Seventeen Patients*

Case No.	Age	Hemoglobin, (Sahli), %	Erythrocytes, Millions	Leukocytes	Polymorphonuclears, %	Lymphocytes, %	Monocytes, %	Eosinophils, %
52	11 mo.	70	....	16,000	45	45	9	0
38	19 mo.	72	4.17	7,600	37	51	9	3
45	19 mo.	86	5.57	11,200	46	40	10	4
39	20 mo.	60	4.70	15,600	62	34	3	0
69	20 mo.	..	....	13,200	55	39	6	0
41	2 yr.	75	4.70	7,800	51	42	4	0
3	2 yr.	..	....	12,500	35	57	0	7
65	28 mo.	95	5.74	9,800	49	44	5	1
46	30 mo.	75	4.50	14,200	61	27	11	0
66	30 mo.	79	4.04	6,400	46	44	10	0
47	30 mo.	..	3.90	6,000	39	48	7	0
25	33 mo.	..	....	14,700	48	41	7	0
14	3 yr.	78	4.99	6,800	24	60	16	0
				12,700	12	88	0	0
48	3 yr.	75	4.80	14,000	84	16	0	0
11	3 yr.	92	4.80	14,500	52	41	3	4
49	6 yr.	76	4.00	7,920	69	24	6	0
63	10 yr.	..	....	5,600	..	..	..	..

bacilli, a great many spirilla and a few vibrios. In the second preparation no spirochetes were found, the vibrios had disappeared and the other organisms were present in about the same numbers as before. Stained smears were negative. They showed many fusiform bacilli but no spirals. Most normal mouths show a greater variety and not infrequently greater numbers of oral anaerobes than were present here. The findings in this case illustrate (1) the diagnostic fallibility of the stained smear and (2) the fact that a severe degree of gingivitis may exist in the practically complete absence of spirochetes in material taken from the gingivodental sulcus.

Blood.—Blood counts were made in 17 cases, with the results shown in table 8. There was no uniformity in the total leukocyte counts, which varied between 5,600 and 16,000 per cubic millimeter, and there was nothing characteristic about the differential leukocyte count. Furthermore, there was no definite relation between the leukocyte count and

the amount of fever at the time the count was taken. Only one estimation of hemoglobin was below 70 per cent (Sahli).

Urine.—The urine was normal in all of the 8 cases in which it was examined.

DIFFERENTIAL DIAGNOSIS

There is seldom any difficulty in recognizing this disease after simple inspection of the mouth. Possible sources of confusion in diagnosis are limited to heavy metal poisoning, blood dyscrasias, scurvy, aphthous stomatitis and Vincent's angina. The stomatitis associated with heavy metal poisoning usually begins relatively insidiously and without fever, runs a more protracted course and is ordinarily accompanied by gastrointestinal symptoms or urinary abnormalities; the history usually reveals a source of arsenic or mercury. Gingivitis and oral ulcerations appear in cases of agranulocytosis and aplastic anemia. A blood count will establish the diagnosis and should be made in any case in which marked prostration and progressive, deep, relatively noninflammatory ulceration occur. Scurvy may be ruled out by the history, the absence of other symptoms and roentgenograms of the bones. Infantile scurvy usually occurs at a somewhat earlier age than acute infectious gingivostomatitis. The interrelation of aphthous stomatitis with acute infectious gingivostomatitis has been discussed in a previous section. Vincent's angina is an entirely separate and distinct entity and is, in my experience, a rare disease. The reader is referred to Rolleston's [25] article for a description of Vincent's angina as it occurs in children.

TREATMENT

Effect of Parenterally Administered Sulfarsphenamine.—In a previous publication [26] Faber reported favorably on the use of sulfarsphenamine in the treatment of this disease. In the present series of cases, at the suggestion of Dr. Faber, I put the previous impression concerning the effect of parenterally administered sulfarsphenamine to the rigid test of giving the drug in alternate cases for comparison. I believe that the number of cases so studied was sufficient to disprove the earlier conclusion and to show definitely that sulfarsphenamine is worthless in the treatment of acute infectious gingivostomatitis. I see no reason to expect that other preparations of arsphenamine would prove more effective.

The rationale of the use of sulfarsphenamine in the treatment of acute infectious gingivostomatitis is based on three assumptions: (1) that the oral anaerobes either are the primary cause or at least impor-

25. Rolleston, J. D.: Vincent's Angina, Brit. J. Child. Dis. **7**:299, 1910.

26. Faber, H. K.: Treatment of Fusospirillary Infections of the Mouth in Children, Am. J. Dis. Child. **36**:463 (Sept.) 1928.

tant secondary invaders; (2) that these organisms invade the tissues, where they are in contact with the circulating arsenic, and (3) that certain anaerobes are killed by the action of parenterally injected sulfarsphenamine. The improbability of the first of these assumptions has been discussed in a previous section. The paucity of pathologic examinations makes it impossible either to prove or to disprove the second. Smith [8] cited rather good evidence in support of the truth of the third assumption, which indicates that certain members of the oral anaerobic group of organisms are susceptible to the action of parenterally administered arsenical compounds. However, Lichtenberg and his associates [14] demonstrated that injections of sulfarsphenamine do not kill fusospirochetal organisms in experimentally produced traumatic oral

TABLE 9.—*Degree of Involvement in Patients Treated and in Patients Not Treated with Sulfarsphenamine*

	No Sulfarsphenamine, No. of Cases	Sulfarsphenamine, No. of Cases
Mild	3	4
Moderate	22	23
Severe	5	4

TABLE 10.—*Local Medication*

Medicament	No Sulfarsphenamine, No. of Cases	Sulfarsphenamine, No. of Cases
Solution of sodium chloride	19	23
Compound solution of sodium borate (Dobell's solution)	4	3
Hydrogen peroxide	6	6
Other medicament	2	0

lesions. Furthermore, case 46 of this series furnishes an example of the failure of sulfarsphenamine to affect the presence of oral anaerobes in the acute lesions of acute infectious gingivostomatitis, whereas case 69 illustrates a severe degree of gingivitis in the practically complete absence of spirochetes.

If the results from the use of sulfarsphenamine in the present series are to be acceptable, it is essential to demonstrate conclusively that the group who received sulfarsphenamine differed in no other significant particular from the controls. Table 9 shows that the proportion of cases in which involvement was clinically mild, moderate or severe was almost exactly the same in the two groups. Chart 5 *A* indicates that treatment was begun at comparable times after onset for both groups. Table 10 shows the close comparability of the local care given the two groups.[27]

27. Six patients in each group received hydrogen peroxide locally. When curves of total duration and duration after treatment were plotted, there was no indication that the children treated locally with hydrogen peroxide made better progress than the entire group.

Chart 5 *B* shows the duration of the disease after treatment was instituted to be almost identical in the two groups. Chart 6 shows that the total duration was similar in the two groups. Again a close correlation between the treated and the control patients is seen in chart 7 *A*, which shows that improvement began at comparable periods after onset in the two groups. Chart 7 *B* indicates that the time at which improvement began after treatment was instituted did not differ significantly in the two groups. Hence parenterally injected sulfarsphenamine neither hastens improvement nor shortens the duration of the disease.

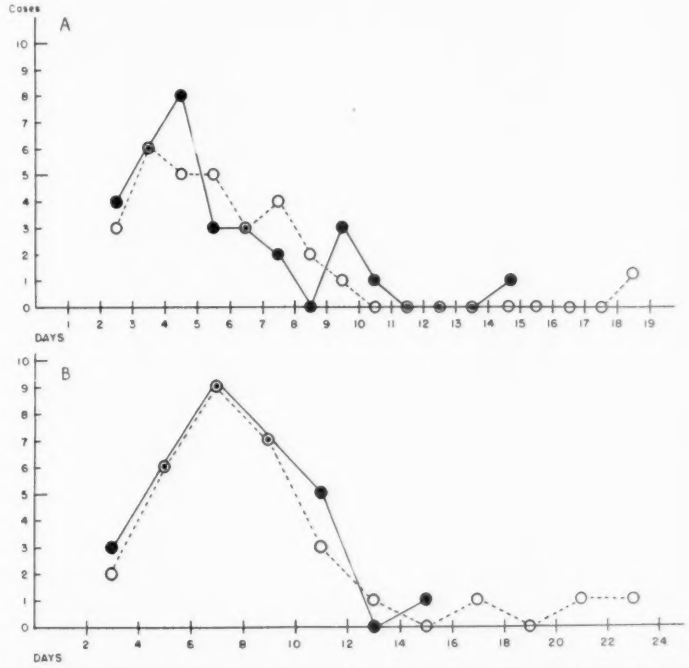

Chart 5.—*A*, the number of days after the onset when treatment was begun for 31 patients given no sulfarsphenamine (solid line) and for 27 patients given sulfarsphenamine (dotted line). *B*, the duration of the disease after treatment was begun for 31 patients given no sulfarsphenamine (solid line) and for 31 patients given sulfarsphenamine (dotted line).

It should not be used, not merely because it is ineffective but because occasionally arsphenamine reactions of a grave or fatal nature occur.

Advocated Treatment.—There is no known means of preventing the sporadic occurrence of acute infectious gingivostomatitis. There is some danger that the infection may be acquired by siblings or by other children coming in close contact with a patient. No adult contact acquired the disease in the present series. A number of the patients were in the hospital ward. The only isolation precautions were physical

separation of the children in cubicles and boiling of the dishes. In no case did the disease occur as a result of contact. In the home there should be little danger if isolation of the patient, consisting merely of physical separation of the infected child, his playthings and his eating utensils from susceptible contacts, is maintained until the oral lesions are completely healed. Reports in the literature indicate that the disease is a dangerous affliction only when it occurs in a markedly debilitated child or in one suffering from measles or typhoid fever.

There is no established specific treatment for acute infectious gingivostomatitis. The general symptomatic treatment of the patient should consist of rest in bed until the fever is gone; an adequate fluid intake, especially during the febrile stage, and administration of sedatives and acetylsalicylic acid as indicated and soft or liquid food which is not salty, spiced, acid or hot. Cool liquids are agreeably received.

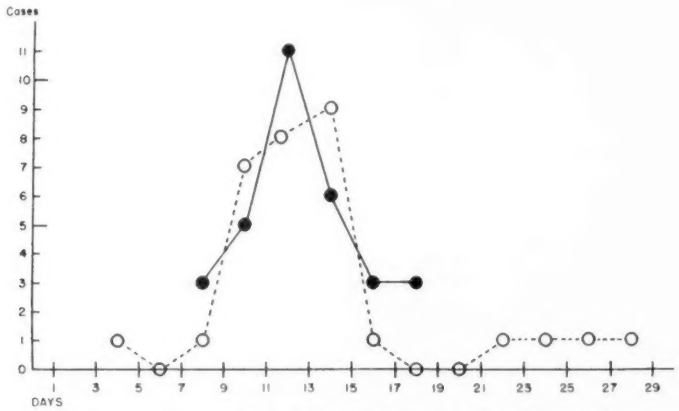

Chart 6.—The total duration of the disease in 31 patients given no sulfarsphenamine (solid line) and in 31 patients given sulfarsphenamine (dotted line).

If there is a particularly important feature of the care of the mouth, it is cleanliness. In young children during the height of the disease it is often practically impossible to apply any local treatment successfully. As improvement sets in, a very soft toothbrush with a mild, nonirritating soapy dentrifice should be gently used. Caustics are dangerous when applied to the inflamed gums. They may cause destruction of tissue with subsequent retraction of the gums. Oxidizing agents, such as dilute hydrogen peroxide and sodium perborate, discourage the growth and multiplication of oral anaerobes and serve the further purpose of diminishing the disagreeable odor. Local applications of the arsphenamines, either dry or in solution, have no rationale. Spirochetes known to be susceptible to arsenic, are not killed by contact with an arsphenamine until the drug has been acted on in the fluids and tissues of the body of the host.

Brennemann [16] did not advise any local care in cases which, from his descriptions, certainly appear to have been instances of this disease. One cannot be at all certain that such local measures as were employed in the present series were of value in shortening the duration of the disease. In 1 instance (case 60) excessive oral filth definitely seemed to delay improvement. It is unlikely that simple gentle cleans-

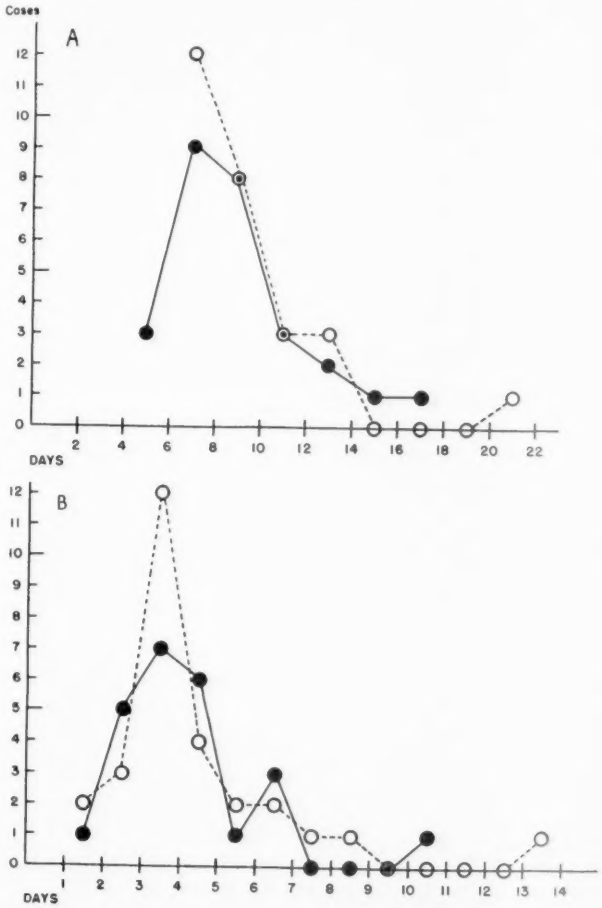

Chart 7.—*A*, the number of days after the onset when improvement began in 27 patients given no sulfarsphenamine (solid line) and in 27 patients given sulfarsphenamine (dotted line). *B*, the number of days after institution of treatment when improvement began in 24 patients given no sulfarsphenamine (solid line) and in 28 patients given sulfarsphenamine (dotted line).

ing, so far as it can be carried out, harms the child, and it is definitely useful in allaying the anxiety of the mother, who is likely to be restive under instructions to do nothing.

SUMMARY

The term "acute infectious gingivostomatitis" is proposed for that common but widely misunderstood and mistreated disease of the mouth in children which is characterized by marked gingivitis, oral fetor, fever and enlargement of the regional lymph nodes. There are serious objections to the use of any one of the numerous terms now applied to this disease. Its cause is unknown. It is unlikely that the oral anaerobic organisms, among which are Vincent's fusiform bacillus and spirillum, play more than a subordinate role in the pathogenesis. Oral anaerobic organisms of various sorts are constant inhabitants of the anaerobic crevices of the normal mouth, even in young children. They may temporarily increase in number during any gingival inflammation. Individually and collectively they are practically bereft of pathogenicity for laboratory animals.

By clinical and laboratory analysis in 69 cases, it has been found that acute infectious gingivostomatitis affects the hardy and well kept child as commonly as it does the malnourished and dirty. It occurs most commonly in the fall and winter months and the incidence is about twice as high in girls as in boys. The peak of age incidence comes at 30 months, while in four fifths of all cases the disease occurs before the fourth birthday. Fever, the symptom most commonly present at onset, ofter precedes the appearance of local lesions by one to three days. The gingivitis and oral fetor frequently reach their peak of intensity after the constitutional symptoms have subsided. More than half of the patients have little round shallow gray oral or labial ulcers. Of the patients in which these ulcers do not occur, about five times as many are girls as boys, while the incidence of ulcers shows no significant sex difference. The disease, from the appearance of the first symptom to complete healing, usually lasts from nine to fifteen days.

The disease is benign and self limited. Recurrence and second attacks are rare. No important complications were encountered in the present series. The affliction is mildly contagious; the principal danger is that infection may occur in young children who come into intimate contact with a patient. Debilitated children or children suffering from measles should be rigidly protected from exposure to this disease.

News and Comment

GENERAL

Physicians Certified by American Board of Pediatrics.—The following physicians have been certified by the American Board of Pediatrics since the last report:

Louis Fischer, New York; Edward Campion, San Francisco; Paul F. Dwan, Minneapolis; George Sherman Frauenberger, Denver; Samuel George Henricke, Portland, Ore.; Albert Lyon Hill, Los Angeles; Clarence Ballard Hills, Berkeley, Calif.; Harry R. Lusignan, Monterey, Calif.; John Johnston Miller Jr., San Francisco; Harry A. Towsley, Ann Arbor, Mich.

CORRECTION

In the article by Dr. Amos U. Christie, entitled "Diagnosis of Syphilis in New-Born Infants: Use of Quantitative Wassermann Tests," in the May issue (Am. J. Dis. Child. **55**:797, 1938), the following errors occurred:

In table 2, case 6, in the column headed "Units," the first and the second figure should read "4" instead of "2." In table 3, case 12, in the column headed "Wassermann Reaction," the second set of figures should read "A42200" instead of "A422000"; in the same case, in the column headed "Units," the third figure should read "18" instead of "8." In case 13, in the column headed "Wassermann Reaction," the first set of figures should read "444200" instead of "4442000"; in the same case, in the column headed "Units," the first figure should read "18" instead of "37."

Abstracts from Current Literature

Biochemistry; Bacteriology, and Pathology

EXPERIMENTAL STUDIES ON THE PRIMARY CHANGES DURING THE FORMATION OF THROMBI. JOSEPH TANNENBERG, Arch. Path. **23**:307 (March) 1937.

One concept of the formation of a thrombus contends that the initial change is the formation of a fibrinous membrane. A more recent explanation indicates that agglutination of platelets is the primary change. The experimental work described by Tannenberg is directed toward an evaluation of these views.

It was demonstrated that the membranous mass precipitated out of blood in the experiments of Dietrich and others is not fibrin but a protein membrane that is soluble in water and obtainable from serum. Consequently, fibrin is eliminated as the constituent of the membrane.

In model experiments outside of the body, wherein blood was allowed to flow through a narrow tube lined by paraffin and containing a thread in its lumen, Tannenberg observed that agglutination of platelets was the primary change. On the surface of air bubbles around which thrombi had formed in the hearts of rabbits killed by air embolism a primary fibrinous membrane was not observed.

C. W. APFELBACH, Chicago.

PRODUCTION OF FAT GRANULES AND OF DEGENERATION IN CULTURES OF ADULT TISSUE BY AGENTS FROM BLOOD PLASMA. H. S. SIMMS and N. P. STILLMAN, Arch. Path. **23**:316 (March) 1937.

In tissue cultures of adult chicken aorta in dilute plasma, fatty changes have been observed. Four factors are described that occur in adult blood plasma: A, B, C and D. Factor A, a serum ultrafiltrate, is necessary for growth of cells in cultures. Factor B is a fat-forming agent. Factor C causes degeneration. Factor D is necessary to bring about cohesiveness of cells. Methods of preparation of these factors are described.

C. W. APFELBACH, Chicago.

FAT DEPOSITION IN ARTERIES TREATED IN VITRO WITH THE B FACTOR. H. S. SIMMS and N. P. STILLMAN, Arch. Path. **23**:332 (March) 1937.

Segments of adult chicken innominate arteries, free from stainable fat, grown in Tyrode solution or in serum ultrafiltrate, were usually free from visible fat. Segments incubated in a fluid containing the B factor showed definite droplets of fat in the medium. When the segments were grown in serum ultrafiltrate for two days and then for four days in the B factor, the accumulation of fat in the intima and media was accentuated.

C. W. APFELBACH, Chicago.

SPIROCHETOSIS IN WHITE MICE PRODUCED BY THE INOCULATION OF MATERIAL FROM CHRONIC PULMONARY ABSCESS, ULCERATIVE STOMATITIS AND PYORRHOEA ALVEOLARIS. C. WEISS, J. Infect. Dis. **61**:143 (Sept.-Oct.) 1937.

Material containing various types of spirochetes, staphylococci, aerobic and anaerobic streptococci, Bacterium melaninogenicum, fusobacteria, organisms of the Bacteroides group and others was obtained from pyorrheic abscesses of the gum, from ulcerative lesions of the mouth and from chronic abscess of the lung. This material inoculated intraperitoneally, subcutaneously or intracutaneously directly or after preliminary passage in series from one guinea pig to another produced spirochetosis in white mice. These animals usually killed off the contaminating bacteria, permitting the spirochetes to develop alone in the blood stream.

The initial time of appearance of the parasites varied from the twenty-eighth to the seventieth day, but by repeated passage of infected blood from mouse to mouse it was possible to shorten the time markedly and to increase the number of spirochetes in the blood stream. A similar effect was accomplished by using mice which had been previously splenectomized and in which the reticuloendothelial cells had been partially blocked by repeated injections of india ink.

At necropsy the spirochetes were demonstrable in several of the organs, including the ovary, testis, lung, liver and kidney, either by means of the dark field or by Dieterle's method of staining sections. The spiral organisms were confined to the inside of the small blood vessels or capillaries, and there was no evidence of inflammatory reaction in any of the organs.

TOOMEY, Cleveland.

THE SIMULATION OF SPIROCHETAL MORPHOLOGY BY FUSIFORM BACTERIA. K. HINE, J. Infect. Dis. **61**:198 (Sept.-Oct.) 1937.

The spiral forms frequently encountered in pure cultures of two species of Fusiformis (F. dentium and F. polymorphus) have been described and depicted. The fundamental differences between these forms and oral spirochetes, which they may superficially resemble, have been noted. These studies yield no evidence to support the idea that fusiform bacteria and oral spirochetes are genetically related.

TOOMEY, Cleveland.

PNEUMOCOCCUS TOXIN AND ANTITOXIN. G. F. DICK and A. K. BOOR, J. Infect. Dis. **61**:228 (Sept.-Oct.) 1937.

The production of a toxin or at least of a toxin-like substance in ordinary broth cultures of the pneumococcus is demonstrated. A method of concentrating this substance is described. This purified and concentrated product makes practicable the production of an antitoxin and facilitates the further study of the toxin-antitoxin mechanism in pneumonia.

TOOMEY, Cleveland.

Metabolism; Infant Feeding; Milk and Other Foods

STUDIES IN IRON TRANSPORTATION AND METABOLISM: I. CHEMICAL METHODS AND NORMAL VALUES FOR PLASMA IRON AND "EASILY SPLIT-OFF" BLOOD IRON. C. V. MOORE, W. R. ARROWSMITH, J. J. QUILLIGAN JR. and J. T. READ, J. Clin. Investigation **16**:613 (July) 1937; II. THE MECHANISM OF IRON TRANSPORTATION: ITS SIGNIFICANCE IN IRON UTILIZATION IN ANEMIC STATES OF VARIED ETIOLOGY. C. V. MOORE, C. A. DOAN and W. R. ARROWSMITH, ibid. **16**:627 (July) 1937.

These two papers present an extensive review of the literature dealing with the nature and amount of nonhemoglobin iron in the blood and the iron in whole blood which is easily split to an ionized form by dilute acids. Improved methods for determining both fractions are given, with data on variations in the plasma iron and in the "easily split-off" iron in subjects with various diseases. It is concluded that iron is transported in the body as plasma iron and that the amount of plasma iron in peripheral blood is influenced by various factors, such as the absorption from the gastrointestinal tract, the iron reserves in the body, the utilization of iron in the synthesis of hemoglobin, the rate of the latter and the hemolysis in the spleen and other tissues.

GUEST, Cincinnati.

PROBLEMS IN INFANT FEEDING. R. M. TYSON, M. Clin. North America **21**:1153 (July) 1937.

Tyson describes his simple feeding methods, based on the energy requirements of the infant. He strongly emphasizes the value of breast feeding, however, and believes that most mothers could nurse their babies if they were willing to make

a satisfactory effort. His feeding directions for normal as well as for premature babies and those suffering from diarrhea, vomiting and other disorders are concise and easy of application. The methods should be especially valuable in the routine feeding of large numbers in clinics and hospitals and for interns and others who are laying a foundation for rational dietetic management of infants.

EUGENE H. SMITH, Ogden, Utah.

UNDERNUTRITION IN CHILDREN. P. S. BARBA, M. Clin. North America **21**:1167 (July) 1937.

Undernutrition is seldom a primary condition. In the search for the underlying cause, the following points should be kept in mind: diet, infections, anemia, psychic or neurologic disturbances, endocrine disturbances and heredity.

It is only by following such leads in taking the history and making the physical examination that effective treatment may be planned. Barba emphasizes the importance of a study of individual variations in the child, his inherited physical peculiarities, his psychic makeup, his environment, his expenditure of energy and the presence of low grade infections. Only after such factors are given careful consideration is it possible to plan a regimen of activities and food which will meet the needs of the undernourished child.

EUGENE H. SMITH, Ogden, Utah.

OBSERVATIONS ON HUMAN SUBJECT SUBSISTING SIX MONTHS ON A DIET EXTREMELY LOW IN FAT. W. R. BROWN, A. E. HANSEN, I. MCQUARRIE and G. O. BURR, Proc. Soc. Exper. Biol. & Med. **36**:281 (April) 1937.

An adult human subject was maintained on a diet extremely low in fat for a period of more than six months. In rats reared on this same regimen the characteristic fat deficiency syndrome of Burr and Burr developed (*J. Biol. Chem.* **82**:247, 1929 and **86**:587, 1930). The iodine number of the fatty acids in the serum was about 93 when the diet low in fat was used as compared with 122 when a general diet was employed. The arachidonic acid and the linoleic acid content of the serum were decreased. There was a tendency to leukopenia but no change in the morphologic characteristics of the blood cells when the diet low in fat was used. A definite decrease in weight in spite of an adequate caloric intake and a slight decrease in blood pressure were noted when the experimental diet was employed. Higher respiratory quotients were encountered after the subject was on the restricted diet for six months. No significant changes were noted in the physical condition. The most marked subjective finding was the marked absence of fatigue. The experimental subject suffered from attacks of migraine, which ceased when the special diet was given.

HANSEN, Minneapolis.

PHOSPHORUS COMPONENTS IN THE BLOOD OF NORMAL AND RACHITIC INFANTS. HARRY BAKWIN, O. BODANSKY and R. TURNER, Proc. Soc. Exper. Biol. & Med. **36**:365 (April) 1937.

The total inorganic and acid-soluble phosphorus components of the blood were studied in normal and in rachitic infants. The fraction hydrolyzable by normal acid (sulfuric or hydrochloric) in ten minutes at 100 F. and the fraction hydrolyzable by bone phosphatase were determined. The acid-insoluble phosphorus was unchanged. In the rachitic infants the acid-soluble phosphorus was reduced. The inorganic phosphate, the readily acid-hydrolyzable phosphorus and the component not hydrolyzable by bone phosphatase all participate in this reduction. The differences between the two groups for both whole blood and red blood cells are statistically significant.

HANSEN, Minneapolis.

NEOPLASMS IN ALBINO RATS RESULTING FROM THE FEEDING OF CRUDE WHEAT GERM OIL MADE BY ETHER-EXTRACTION. L. G. ROWNTREE, J. LANSBURY and A. STEINBERG, Proc. Soc. Exper. Biol. & Med. **36**:424 (April) 1937.

In 14 rats which were fed an ether-extracted crude wheat germ oil in addition to their diet tumors developed. The tumors were malignant, as was demonstrated by the fatal outcome, the morphologic structure of the tumor cells and the inoculability through six generations. The implants grew with great rapidity, attaining a large size, and resulted in the death of the animals. Microscopically, both the primary and the transplanted tumors were composed chiefly of spindle cells. The cellular areas of the tumors and the evidence of rapid proliferation suggest a sarcomatous nature. Negative results have been obtained by feeding refined ether-extracted wheat germ oil.

HANSEN, Minneapolis.

PRODUCTION OF SARCOMA IN ALBINO RATS AS A RESULT OF FEEDING CRUDE WHEAT GERM OIL. G. M. DORRANCE and E. F. CICCONE, Proc. Soc. Exper. Biol. & Med. **36**:426 (April) 1937.

Dorrance and Ciccone, working at the Oncologic Hospital, elaborated on the work of Rowntree, Lansbury, Steinberg and Anderson (*Proc. Soc. Exper. Biol. Med.* **36**:424, 1937) and found that by increasing the intake of the ether-extracted crude wheat germ oil intra-abdominal tumors could be produced in 100 per cent of rats in sixty days. The point of origin thus far has been consistent only in that the tumors have been found in the peritoneal cavity. If an animal is not killed, the tumor becomes large enough to cause death, often by intestinal obstruction. Two hundred and sixty rats received implants with 100 per cent successful "takes," and many of the tumors were retransplanted through 15 successive generations. The tumors have been transplanted both intraperitoneally and subcutaneously. Histologically and clinically, the tumors have all the characteristics of a spindle cell sarcoma.

HANSEN, Minneapolis.

USE OF ACIDIFIED MILK FOR NORMAL AND ATHREPTIC INFANTS. A. BOHN, Bull. Soc. de pédiat. de Paris **35**:110 (Feb.) 1937.

An acidified dried whole milk was used in the preparation of feedings for 125 normal and athreptic infants under 3 months old. It was well taken and well digested. Good results were also obtained from its use in infants with acute and more chronic digestive disturbances and in those with anorexia and those who were taking only small amounts of concentrated high caloric mixtures.

BENJAMIN, Montreal, Canada.

FEEDING OF INFANTS WITH GRAIN OF HIGH PHOSPHATE CONTENT. G. DOMENICONI, Lattante **8**:159 (April) 1937.

Farina grown on soil highly fertilized with phosphates will show about one-third more phosphorus than the usual farina obtained on the market. Observations were made on the feeding of bottle-fed infants a mixture of high phosphate grain and cow's milk. The children digested and absorbed the feedings well and showed satisfactory gains in weight. The excess of phosphorus was in part eliminated by the urine and in part retained by the body. The amount excreted in the feces was not increased.

HIGGINS, Boston.

RECTIFICATION OF THE HUMAN DIET. A. G. ALARCÓN, Rev. mex. de puericultura **7**:343 (Aug.) 1937.

Alarcón reviews the general principles of the right choice of foods and of the treatment of food deficiences and discusses various types of human diets.

First Principle.—The food of a child who has passed infancy, say one 15 months old, must in general consist of solids, and difficulty and dangers are met if the food is liquid.

Second Principle.—Outside of the water in the physicochemical makeup of foods, the only liquids that necessarily must enter the digestive tract of a mammal are mother's milk and water.

Third Principle.—It is a common error of man—the more civilized, with the more reason—to suppose that the digestive process can be imitated by man.

Fourth Principle.—All knowledge relating to the chemistry of foods, the role of vitamins, etc., is at the base of the science of rational feeding, but it is first necessary to refer to the physical constitution of the food.

HERRON, Monroe, La.

EXCRETION OF ANTIANEMIC HEPATIC SUBSTANCES IN HUMAN MILK. K. SCHWARTZER and D. GOEDECKEMEYER, Monatschr. f. Kinderh. **71**:22 (Aug.) 1937.

To the diet of a wetnurse was added a liver preparation, hepatrat. The nurse's milk was given to rats that had been made anemic. As a control, the milk of another nurse not receiving the liver preparation was fed to anemic rats. The rats receiving the former showed much better recovery.

GERSTLEY, Chicago.

CEREAL SOLUTIONS IN INFANT FEEDING. J. CSAPÓ, Orvosi hetil. **81**:775 (July) 1937.

It is the generally accepted opinion that cereal solutions are colloidal solutions of carbohydrates and proteins. In the preparation of these solutions one regards only the percentage of the base material and speaks about 5 per cent flour soup and about 10 per cent rice water, and one does not take into account what amounts of these base materials dissolve during the cooking. It is important to know what part of a cereal dissolves during a certain period of cooking. Csapó experimented with various cereals to find out what part of the base material dissolves in various dilutions and in what time. He found that 6.5 per cent of the base material of a 10 per cent solution of oriza (dried rice water, a preparation of the Hungarian firm Krompecher) dissolves after five minutes' boiling, whereas in two hours only 2 per cent of common rice dissolves, 1.6 per cent of flour and only 1 per cent of oatmeal. In cooking oriza the maximum of solution is reached in five minutes, whereas in cooking rice, flour or oatmeal the amount of material dissolved rises slowly and gradually. Chemical analysis showed that it is chiefly the carbohydrates which dissolve, whereas the proteins for the most part remain insoluble. The cereal solutions are therefore colloidal solutions of carbohydrates with big molecules.

GÖTTCHE, Budapest, Hungary.

FEEDING THE BABY IS THE SUBJECT OF DISCUSSION BY THE LEAGUE OF NATIONS, SECTION OF HYGIENE. J. STEIN, Zycie Dziecka **6**:105 (April) 1937.

Many nations were represented at the meeting. Poland was represented by Prof. Mieczyslaw Michalowicz. The main discussion was first centered on how to feed babies. The importance of vitamins, fresh air and sunshine was emphasized. Another important phase of the discussion was concerned with the question of how to feed children of school age.

At the next conference the subject for discussion will be the relation of iron and calcium to children's nutrition, also the use of viosterol and ultraviolet rays, which have antirachitic importance.

KRUPINSKI, Chicago.

EXPERIMENTAL STUDIES OF CRANIOTABES: THE BLOOD SUGAR AND INORGANIC PHOSPHORUS OF RABBITS FED LACTOSE AND SUCROSE. T. YOSHINARE, Acta pædiat. japon. **43**:823 (June) 1937.

The sugar content and the inorganic phosphorus content of the blood in rabbits fed lactose and sucrose undergo changes which may account for the acidotic lesions in the bones, particularly craniotabes. After a gavage of lactose in the proportion of 15 Gm. per kilogram of body weight, the blood sugar shows an average increase of 0.056 per cent, the hyperglycemic period lasting for nearly five hours. Inorganic phosphorus, on the other hand, decreases after the administration of lactose, but after that of sucrose the changes are variable. The decrease in blood phosphorus after the feeding of lactose can be prevented by simultaneous injection of insulin, but injection of alkalis has no effect.

KATO, Chicago.

NITROGENOUS SUBSTANCES IN THE URINE OF NORMAL INFANTS. M. ISHIBASHI, Acta pædiat. japon. **43**:909 (June) 1937.

The daily urinary excretion of nitrogenous substances per kilogram of body weight was determined in 16 healthy infants. The results are as follows: uric acid, 0.013 Gm.; creatinine, from 6.9 to 15.3 Gm.; urea nitrogen, from 65 to 87 per cent of the total nitrogen, and ammonia nitrogen, from 4.3 to 18.4 per cent of the total nitrogen.

KATO, Chicago.

HEREDITARY OBESITY. P. SELANDER, Hygiea **99**:481 (July 15) 1937.

A boy of 12 had a body weight of 100 Kg. and a height of 154 cm. His weight at birth was 3,700 Gm. After whooping cough at 5 years of age, his weight increased rapidly. He was of normal intelligence. The external genital organs were normal. The sella turcica was normal, The basal metabolism was slightly decreased. The distribution of fat corresponded to that in adiposogenital dystrophy. A study of the immediate family and of the ancestors revealed multiple cases of obesity and gigantism on the father's as well as on the mother's side.

WALLGREN, Göteborg, Sweden.

EXAMINATION OF THE TISSUE METABOLISM IN SKIN AND PLEURA. G. BOSTRÖM, Svenska läk.-sällsk. förhandl., June 30, 1937, p. 141.

By means of Warburg's manometric apparatus, the metabolism of isolated specimens of normal and of allergic skin were examined and the results compared. It was found that allergic skin, whether it presented microbic allergy or a drug exanthem, showed much stronger metabolism than macroscopically normal skin. Specimens of pleura from persons with pleurisy, examined by the same method, disclosed much more intense sensitivity to tuberculin than specimens of normal skin from the same persons.

WALLGREN, Göteborg, Sweden.

INFLUENCE OF APPROPRIATE TECHNIC ON THE MAINTENANCE OF THE SECRETION OF BREAST MILK IN COMPLEMENTARY FEEDING. A. WALLGREN, Svenska läk.-tidning. **34**:744 (May 21) 1937.

Every effort must be made to increase lactation in mothers with an insufficient amount of breast milk. The secretion of breast milk should be increased until complementary food is no longer needed or, if that is not possible, it should be maintained along with complementary feeding until the infant is to be weaned. In order to guarantee the best possible secretion of breast milk in mothers whose babies are given complementary feeding, some important details in the technic of the feeding must be considered: The number of feedings should not be too few (not less than five); every meal must begin with the mother's breast, and the breast must be drained. The complementary food should preferably be given with

a spoon. Complementary feeding is a difficult task, and without competent advice the inexperienced mother almost always fails to carry it through. The importance of competent teaching is shown by the duration of secretion of breast milk in mothers with babies given complementary feedings when the infants are supervised by infant welfare centers. In this group (192 infants) 98 per cent got breast milk up to the third month; 75 per cent, to the sixth month, and 25 per cent until the ninth month. The figures for the group not supervised (130 infants) were 40, 17 and 3 per cent, respectively. WALLGREN, Göteborg, Sweden.

Vitamins; Avitaminoses

VITAMIN C SATURATION LEVELS IN THE BODY IN NORMAL SUBJECTS AND IN VARIOUS PATHOLOGICAL CONDITIONS. P. FINKLE, J. Clin. Investigation **16:** 587 (July) 1937.

This paper presents a test for saturation with or subclinical deficiency of vitamin C and the results of studies in which this test was made in 127 subjects (ages not stated). In normal persons the daily twenty-four hour output of vitamin C was between 13 and 20 mg. There appeared to be no evidence that deficiency of vitamin C had causal relationship to any pathologic condition other than scurvy. Especial emphasis was placed on the negative evidence for such a deficiency in thrombocytopenic purpura. A persistently low level of excretion of vitamin C was found in acute lupus erythematosus, but Finkle maintains that a low level of excretion of vitamin C does not warrant the conclusion that deficiency of this vitamin plays an etiologic role in this or other purpuric conditions.

GUEST, Cincinnati.

PELLAGRA IN AFRICAN CHILDREN. H. C. TROWELL, Arch. Dis. Childhood **12:**193 (Aug.) 1937.

Previous observations in Africa have revealed a syndrome in young native children characterized by irritability, edema, gastrointestinal signs and complex changes in the skin. In Nairobi, Kenya Colony, a detailed investigation of the clinical, biochemical and pathologic changes was made in 26 cases, in 6 of which postmortem examinations were carried out. Microcytic and macrocytic forms of anemia were demonstrated, in addition to the signs previously noticed by other observers; the stools were analyzed and found to be fatty. Neurologic signs of hypertonia, increased tendon reflexes and an "extensor" response were demonstrated. The blood sugar curve was low. At postmortem examination a remarkable atrophy of the thymus gland was observed. All the known clinical findings of pellagra were therefore present in this syndrome, and the anomalous feature of edema, anemia and atrophy of the thymus can all be related to the deficiency of vitamin B_2 in a diet poor in animal protein, deficiencies which are more clearly related to pellagra than to any other known disease.

KELLY, Milwaukee.

VITAMIN B_1 DEFICIENCY IN INFANCY: A CRITICAL REVIEW. M. R. PRICE, Arch. Dis. Childhood **12:**213 (Aug.) 1937.

From a survey of the literature it appears that: The amount of vitamin B_1 required by a nursling is about 200 units a day. Many nursing mothers do not have sufficient vitamin B_1 in their food to pass on an adequate supply to their babies. By analogy from animal experiments some common infantile ailments may arise from deficiency of vitamin B_1. There is sufficient evidence to make feeding experiments on young infants desirable. KELLY, Milwaukee.

ELECTROTHERAPY PAPERS: III. ULTRA-VIOLET IRRADIATION—CLINICAL APPLICATIONS. A. P. CAWADIAS, Brit. J. Phys. Med. **12**:70 (Aug.) 1937.

In a series of papers on the use of ultraviolet rays in the treatment of many varied conditions, Cawadias emphasizes the constitutional effect of these rays. He attributes the reported failure of the treatment in certain instances to the use of too large doses. He believes that most persons, particularly children, subjected to ultraviolet irradition, if given suberythematous doses, experience a diminished tendency to contract colds.

HARTMAN, Cleveland.

VALUE OF ULTRA-VIOLET LIGHT IN INDUSTRIAL DISTRICTS. E. MORTON, Brit. J. Phys. Med. **12**:116 (Oct.) 1937.

The writer has in the course of a number of years been in charge of several clinics for the treatment of diseases by means of artificial light. She discusses dosage, technic and the value of such treatment in specific conditions. In conclusion, she states that ultraviolet ray therapy is not a specific for any disease with the possible exception of rickets and that these rays cannot take the place of such adjuvants as drugs, hygiene (including adequate rest), extra nourishment or surgical procedures. However, with these facts in mind, she believes that no other single method of treatment is as generally beneficial in the chronic ailments of children as light therapy.

HARTMAN, Cleveland.

STUDIES ON VITAMIN C: EFFECT OF COOKING AND STORAGE ON THE VITAMIN C CONTENT OF FOODSTUFFS. M. N. RUDRA, Indian J. M. Research **25**:89 (July) 1937.

The most destructive way of cooking is to boil in a large open pot and discard the cooking water. Frying in fat is not as harmful to the vitamin C content of food. Spinach boiled two minutes is lower in vitamin content than raw spinach. Refrigeration of goat's liver for two days at 5 C. causes little change; refrigeration for eight days causes a loss of 44 per cent. Refrigeration of cauliflower causes no loss of vitamin C.

SNELLING, Toronto, Canada.

FIVE CASES OF BERI-BERI TREATED WITH ATROPINE. D. K. DEB, J. Indian M. A. **7**:20 (Oct.) 1937.

Deb reports that 5 patients with beriberi were cured by repeated subcutaneous injections of atropine. All special vitamin B–containing products were omitted from the diet, but the patients were advised to take food rich in vitamin B. Other patients treated by the administration of special vitamin B–containing products alone obtained no permanent benefit.

GONCE, Madison, Wis.

SO-CALLED "VITAMIN F." H. R. HUDSON, South African M. J. **11**:650 (Sept. 25) 1937.

Hudson briefly reviews the subject of "vitamin F," especially in respect to its use in the cosmetic industry. This so-called vitamin is an unsaturated fatty acid, linoleic acid.

GONCE, Madison, Wis.

REVIEW OF THE ITALIAN CONTRIBUTIONS TO THE STUDY OF MINERAL BALANCE IN INFANTS IN RESPECT TO THE PATHOGENESIS OF RICKETS AND OF TETANY. D. PACCHIONI, Arch. ital. di pediat. e puericultura **5**:297 (Aug.) 1937.

Pacchioni, of the University of Genoa, in a review of 132 Italian articles on this subject, summarizes his considerations as follows:

Phosphorus.—The phosphatases are activated not only by actinic radiation but also probably by radiation emitted from the living substance, especially in the physiologic disintegration of certain organic phosphorus compounds, chiefly nuclear.

The activation of phosphatases appears as a function of cellular metabolic activity. In rickets, the nucleocytoplasmic activity of cartilage cells being diminished, there is less retention of organic phosphorus compounds and consequently less activation of phosphatases and less transformation of phosphoric esters into inorganic compounds. Furthermore, in rickets there is a particular neurohormonic situation having its basis in a relative vasomotor insufficiency.

Calcium.—The spasmophilic action associated with a calcium deficit depends perhaps on the relationship between calcium and guanidine metabolism. Therein tetany resembles more a disturbance of the muscular than of the nervous system.

Potassium.—As the organism tends to reestablish the electrolytic equilibrium rapidly, so soon as it is disturbed, the dystonia of tetany persists, perhaps because of changes arising in the tissues.

Magnesium.—The consequences of the diminution in calcium in the blood and in the tissues in tetany are probably compensated for, at least in part, by magnesium. In tetany, magnesium is less diminished than calcium.

The paper was presented by Pacchioni at the International Congress of Pediatrics at Rome in 1937.

DOOLEY, New York.

ACTION OF VITAMIN A ON THE BLOOD SUGAR CURVE. M. ANTONINI, Lattante **8**:551 (Oct.) 1937.

Blood sugar curves were plotted from determinations made during fasting and each half hour following the ingestion of 1 Gm. of dextrose per kilogram of body weight. Two curves were made from each of 20 patients, one as a control and one after the patient had taken vitamin A for from six to eleven days. Both the curve during fasting and the curve following ingestion of dextrose were lower when the patient was receiving vitamin A.

HIGGINS, Boston.

DETERMINATION OF VITAMIN C. A. ESCUDERO and S. G. WAISMAN S., Rev. méd. latino-am. **22**:772 (April) 1937.

Escudero and Waisman review the methods of quantitative determination of ascorbic acid in biologic mediums and describe a method applicable to the urine. The urine is acidified with 5 per cent acetic acid and titrated with 2,6-dichlorophenolindophenol.

DWYER, Kansas City, Mo.

FOUR CASES OF RICKETS. R. SOTO and L. VARGAS, Rev. mex. de puericultura **7**: 388 (Aug.) 1937.

Soto and Vargas present these 4 cases in complete detail as to history, diagnosis, differential diagnosis, treatment, roentgen examination and follow-up roentgen examination.

HERRON, Monroe, La.

ANTIRACHITIC VALUE OF COW'S MILK IN THE CITY OF CORDOBA, IN THE ARGENTINE REPUBLIC. P. DEPETRIS, Rev. Soc. argent. de biol. **13**:187 (July) 1937.

Employing the "line test" of MacCollum and his collaborators, Depetris found that the addition of 3 cc. of milk per day to the diet exercised a curative influence on experimental rickets in rats. This curative action was obtained more readily by the use of pasteurized milk than by the use of boiled or raw milk. The cows from which the milk of Cordoba is obtained are allowed to graze at will on the open range, consuming sorghum, sudan grass, wheat and alfalfa. The antirachitic value of the milk did not vary seasonally, that obtained in winter having the same curative effect as that obtained in summer.

KALISKI, San Antonio, Texas.

FURTHER EXPERIMENTAL WORK ON THE RELATION OF VITAMINS TO THE HEALING OF WOUNDS. H. J. LAUBER, Beitr. z. klin. Chir. **161**:565, 1935.

Lauber stresses the fact that more attention should be paid to nutrition in operative cases.

In regard to local application of vitamins to wounds he reaches the following conclusions: Vitamin A does not hasten healing. As a matter of fact, in concentrated doses it delays healing. Vitamin B and vitamin C in concentrated doses slightly hasten healing. Vitamin D in light doses hastens and in concentrated doses delays healing.

In regard to oral ingestion of vitamins he shows the following results: Vitamin A in light doses causes healing. In concentrated doses it delays healing. Vitamins B, C and D have no apparent influence.

RUBIN, Boston.

VITAMIN D AND BONE DEVELOPMENT. J. MARX, Beitr. z. klin. Chir. **162**:213, 1935.

From his own observations and those of others in literature of recent date, and also on theoretical grounds, Marx states that the normal formation of bone in a well organism cannot be hastened by giving isolated vitamin D. His observations and experiments show that when in patients whose diet has been vitamin poor the formation of callus is very slow no success is seen with an intake of vigantol (a preparation of irradiated ergosterol), and when there is a possibility that excess may cause damage, as in patients with difficult, long drawn-out healing of fractures, there is no justification for giving it.

RUBIN, Boston.

FURTHER EXPERIENCES IN THE SHOCK TREATMENT OF RICKETS WITH VITAMIN D_2. G. O. HARNAPP, Monatschr. f. Kinderh. **71**:193 (Oct.) 1937.

Harnapp was able to obtain vitamin D_2 in crystalline form. He uses the term "D_2" apparently for irradiated ergosterol. He found the shock therapy to be especially efficient in severe rickets associated with spasmophilia. A dose of from 12 to 15 mg. of D_2 was always followed by prompt healing. For the premature infant the dose should be somewhat smaller but above 7.5 mg. This treatment gives a speedier recovery than results from the use of the regulation daily dose. No toxic manifestations were noted.

GERSTLEY, Chicago.

TREATMENT OF FLORID RICKETS WITH VITAMIN D_3. H. J. HARTENSTEIN, Monatschr. f. Kinderh. **71**:215 (Oct.) 1937.

Hartenstein terms the product obtained by irradiating cholesterol vitamin D_3. This substance seems to be identical with the vitamin obtained from the liver of the tuna fish. He submits nine roentgenograms of bones showing that the results from the use of vitamin D_3 are as satisfactory as those from the use of vitamin D_2 (vigantol, a preparation of irradiated ergosterol).

GERSTLEY, Chicago.

VITAMIN D CONTENT OF SMALL HERRINGS. I. SALONIUS, C. WEGELIUS and R. WEGELIUS, Finska läk.-sällsk. handl. **80**:245 (March) 1937.

Oil made of salted boiled small herrings was examined as to its content of the antirachitic vitamin D. This work was based on prevention of rickets in rats fed a rachitogenic diet. The degree of rickets was determined by roentgenograms and by analyses of the calcium content of the tibia. One gram of oil from this fish corresponded to from 100 to 200 international units of vitamin D. The preventive dose for an infant corresponded to one salted small herring per day.

WALLGREN, Göteborg, Sweden.

SEVERE RICKETS AND TETANY IN A CHILD. N. LANDORF, Svenska läk.-tidning. **34**:637 (April 30) 1937.

Up to the age of 1½ years, this child, a girl, was nursed at an infants' home, from which she was discharged without any signs of rickets. Thereafter the

parents took care of her. She was permitted to eat what she liked, which was principally milk, cacao and bread. She never ate any vegetables, fruits or cod liver oil and was seldom outdoors. The disability in walking produced by her severe rachitic bone deformities was the reason she was brought for examination. In addition to the rachitic changes there was latent tetany (galvanic hyperexcitability and a blood calcium content of 8.8 mg. per hundred cubic centimeter). She was treated with viosterol, calcium and an appropriate diet and was discharged healthy after a couple of months. WALLGREN, Göteborg, Sweden.

Hygiene; Growth and Nutrition; Public Health

FACTORS RESPONSIBLE FOR FAILURE FURTHER TO REDUCE INFANT MORTALITY. H. N. BUNDESEN, W. I. FISHBEIN, O. A. DAHMS and E. L. POTTER, J. A. M. A. **109**:337 (July 31) 1937.

Death certificates often give incorrect causes for neonatal deaths. Both the International List and the Manual of Joint Causes are misleading in classifying causes of deaths. Many deaths are classified as due to prematurity when they are due to other causes. Further reduction in neonatal mortality requires efforts to prevent prematurity and to provide adequate obstetric care for patients. If correct causes of death are given, the health officer may be effective in preventing neonatal deaths. Several tables are given of the common causes of death as determined by a committee which passed on all autopsies performed on newborn infants in Chicago during the period of the study. BONAR, Salt Lake City.

MATERNAL AND CHILD-HEALTH AND CRIPPLED CHILDREN'S PROGRAMS UNDER THE SOCIAL SECURITY ACT. D. A. MURRAY, New England J. Med. **217**:94 (July 15) 1937.

The Social Security Act authorizes appropriations for the purpose of enabling each state to extend and improve (especially in rural areas and areas of severe economic distress) services for promoting the health of mothers and children and services for crippled children. The annual appropriations are $3,800,000 for maternal and child health services and $2,850,000 for services for crippled children. The major portion of the fund paid to a state to provide maternal and child health services and all the fund for services for crippled children must be matched by the state.

The Children's Bureau has followed this procedure: It has a general advisory committee on maternal and child health and welfare services and has a special technical committee on each of the two divisions of the program—maternal and child health services and services for crippled children. Other special committees will meet from time to time, such as a committee on maternal welfare, one on training of personnel for the crippled children's program and one on hospitals for crippled children. The success of the Social Security Act will depend on combined local, state and federal efforts in developing well rounded state programs, which means adequate participation by local committees, qualified personnel to carry on the programs and the interest and cooperation of medical, nursing and social welfare groups. GENGENBACH, Denver.

COMMENTARIES ON LAW NO. 12,341, WHEREBY THE DIRECTION FOR THE PROTECTION OF MOTHERS AND CHILDREN IS ESTABLISHED IN AGENTINA. A. O. CHANS, Bol. Inst. internac. am. de protec. a la infancia **11**:5 (July) 1937.

Chans refers to law 12,341, whereby an organization for the direction of mothers and children is created in the Argentine Republic. The law provides that at least one health center for mothers and children with the necessary equipment be established in every community and that traveling health centers be installed in motor cars and trains. The Child Division of Social Hygiene is to study the

causes of maternal and child morbidity and mortality from the point of view of prevention. Other divisions will have to do with the compilation of further legislation relating to the supervision of child mendicancy, child delinquency, communicable diseases and milk sanitation. LESLIE, Evanston, Ill.

THE CHILDREN'S HOME: AN ARGENTINE WELFARE SYSTEM FOR NEGLECTED CHILDREN. V. DELFINO, Bol. Inst. internac. am. de protec. a la infancia **11**:29 (July) 1937.

Delfino makes reference to the Children's Home, an institution founded in Buenos Aires, Argentina, in 1910 by Mrs. Julia S. de Curto on the plan of a family home for a group of from 30 to 35 pupils. There are at present 4 such homes in Buenos Aires, with a total of 150 children. LESLIE, Evanston, Ill.

ORGANIZATION OF THE HEALTH DIVISION OF THE CHILDREN'S COUNCIL. L. M. PETRILLO, Bol. Inst. internac. am. de protec. a la infancia **11**:53 (July) 1937.

Petrillo presented this paper in the competition opened by the Children's Council to provide for the post of chief of the said division.

All the points of chapter 9 of the Children's Code are included, namely:

I. Organization of the study of infant morbidity and mortality

II. Control of communicable diseases in childhood

III. School hygiene service

IV. Traveling center of child hygiene

V. Child labor

VI. The physical education of children controlled by the state by means of the Health Division

LESLIE, Evanston, Ill.

CARE OF ADOLESCENT ORPHANS BY PRIVATE FAMILIES. H. DINTER, Zycie Dziecka **6**:97 (April) 1937.

Dinter presents, pro and con, the reasons for the proposed ways of taking care of these young persons. To allow private families to take care of them has certain advantages in that it cuts down expenses in public institutions, enables the children to be brought up as good citizens and impresses on them an understanding of family life, which may help them in later years. However, from the standpoint of the author, institutional life is much better, provided the institution is run properly, i. e., to the best advantage of the orphan. KRUPINSKI, Chicago.

Newborn

SOME PROBLEMS IN THE NURSERY OF THE NEW-BORN. J. ZAHORSKY, Arch. Pediat. **54**:617 (Oct.) 1937.

The practice of placing all newly born infants in one nursery is unwise, as it exposes them to sources of infection that could be controlled if all newborn infants were isolated in separate rooms or cubicles.

Soon after birth the infant should be cleansed with sterile oil and the oil removed with soap and water. This must be done with a strict aseptic technic. Then the baby should not be given a general bath of any kind for a week.

Cleansing the diaper region with a weak solution of soap seems rational, but the soapy water must be removed with plain water. Then the parts should be dried. For this purpose pledgets of sterile cotton may be used. Oil may be placed in the creases if necessary. Cleansing the diaper region of the artificially fed baby with a solution of boric acid seems rational.

Some kind of disinfection for the nurse's hands before she passes from one infant to another is a safeguard. The hands may be dipped in a weak antiseptic

solution (chlorine water, saponated solution of cresol, 70 per cent alcohol or a solution of mercuric bichloride). Scrubbing the hands after each change is not practicable.

The nurse who changes the diaper must not touch the nipple, as in the Dick technic. The dressing and undressing of the baby should be controlled by an aseptic technic. For normal infants, prelacteal feedings should be limited to sterile water, and this should be given with a spoon.

If the mother's milk is inadequate, a consultation with the obstetrician should be demanded.

ORR, Buffalo.

ATTACKS OF APNEA OF GRIPPAL ORIGIN; EFFECT OF CARBOGÈNE. RIBADEAU-DUMAS, GHARIB and SIGUIER, Bull. Soc. de pédiat. de Paris **35**:245 (April) 1937.

A 13 day old infant had fever and rales in the chest. He had repeated apneic spells lasting from three to four minutes. Oxygen was administered, and his cyanosis improved, but apnea recurred. After carbogène was used, the apnea did not recur. Congestion of the heat-regulating mechanism is offered as a possible cause of the apneic attacks. Roentgenologic shadows of increased density were present at the apex of the left lung and along the greater interlobar fissure on the right. The spinal fluid was normal.

BENJAMIN, Montreal, Canada.

PARALYSIS OF THE PHRENIC NERVE IN THE NEWBORN. C. COCCHI, Riv. di clin. pediat. **35**:769 (Sept.) 1937.

Three cases of birth trauma causing paralysis of the phernic nerve and of the brachial plexus are reported by Cocchi. One infant died at 2 months of age, and a necropsy was performed; the second showed complete recovery, while the third still presented residual motor insufficiency of the right side of the diaphragm at the age of 4 years.

The brachial plexus and the phrenic nerve, being located more laterally and in a deeper plane, are much more likely to be injured in a breech presentation than the vagus or cervical sympathetic nerves. On turning the head, the tendon of the omohyoid muscle presses the phrenic nerve against the scalenus muscle and the underlying vertebral process; stretching of the nerve may thus be prevented and trauma and tearing of the nerve result.

HIGGINS, Boston.

DATA ABOUT THE ORIGIN OF THE IMMUNITY OF NEWBORN INFANTS. L. SCHNEIDER and J. SZATHMÁRY, Orvosi hetil. **81**:278 (March 20) 1937.

Schneider and Szathmáry in experiments on horses, goats and swine pointed out that the blood serum of newborn animals does not contain agglutinins, antibactericidal bodies or antitoxins. These materials can be found only after the animals have been suckled on their mother's milk, especially on the colostrum. It is obvious that such substances get into the organism of the newborn animal not through the placenta but through the mother's milk, especially through the colostrum.

O. GÖTTCHE, Budapest, Hungary.

SOME CASES OF ICTERUS GRAVIS NEONATORUM AND CONGENITAL ANEMIA. W. H. OEBERIUS KAPTEYN, Maandschr. v. kindergeneesk. **6**:397 (July) 1937.

This is a description of 3 cases of icterus gravis neonatorum, 2 of which terminated fatally very soon, and of 2 cases of congenital anemia in families in which the birth of the children with this condition had been preceded by the birth of children with, respectively, icterus gravis neonatorum and universal hydrops. The author assumes that the three conditions are fundamentally the same, differing principally in the time of onset, the intensity of the destruction of the blood, degree of hepatic function and the possibility of regeneration of the red blood corpuscles.

VAN CREVELD, Amsterdam, Netherlands.

Acute Contagious Diseases

DEAFNESS ASSOCIATED WITH MENINGOCOCCEMIA. H. LEICHENGER and S. M. ABELSON, Arch. Otolaryng. **26**:306 (Sept.) 1937.

The authors present the case of a 22 year old man who did not have meningitis but who had meningococcemia; they conclude that the patient's deafness was possibly caused by an exotoxin of the meningococcus. GREENWOOD, Chicago.

POLIOMYELITIS IN LOS ANGELES IN 1934. MARY F. BIGLER and J. M. NIELSEN, Bull. Los Angeles Neurol. Soc. **2**:47 (June) 1937.

The epidemic of anterior poliomyelitis in California in 1934 was characterized by clinical features at such variance with those of other epidemics as to suggest that a new disease had appeared. Bigler and Nielsen report 4 cases in detail and 4 others briefly to illustrate the typical features. The most striking characteristic was the tendency to polyneuritic manifestations. The onset was frequently accompanied by marked pain and muscular tenderness throughout the body and severe hyperalgesia of the skin, so that even light contact with bedclothes became painful. Localized urticaria, a peculiar firm, nonpitting edema, painful muscle cramps and spasms and loss or perversion of sensibility over wide areas were observed in many cases. Flaccid paralysis, often involving one half of the body, was the rule. In spite of the flaccidity, the deep reflexes were not uncommonly preserved, or even exaggerated, and were accompanied sometimes by a Babinski reaction. The electrical responses were often normal. Cerebral involvement was common and produced such symptoms as irrationality, hallucinations, delusions, visual agnosia, diabetes insipidus, somnolence or insomnia and amnesia. Bulbar forms with paralyses of the cranial muscles were also seen. Meningeal irritation was evidenced by headache, stiffness of the neck and the Kernig sign. The spinal fluid was normal in all respects in cases which the authors described.

The course of the disease was often greatly protracted, with periods of remission and relapse occurring as late as two years after the onset. Some forms of the disease were gradually progressive, although the "almost universal" recovery from paralysis was striking. One brain at postmortem examination was found normal. There was extensive softening of the gray matter of the spinal cord, especially in the lateral horns. In the lumbar region of the cord the posterior horns were selectively involved, and the cells of Clarke's column were largely destroyed. The anterior horn cells were relatively well preserved. There was little secondary scarring. The peripheral nerves showed degeneration of myelin sheaths.

Bigler and Nielsen state that in this epidemic the unusual features were almost all seen in patients over 20 years of age. They leave open the question as to the ultimate nature of the disease and state that it is not settled whether another disease was present with the poliomyelitis.

MACKAY, Chicago. [ARCH. NEUROL. & PSYCHIAT.]

POLIOMYELITIS. ARCHIBALD L. HOYNE, Illinois M. J. **72**:217 (Sept.) 1937.

After a review of the literature and a discussion of poliomyelitis from the standpoint of his own as well as other authors' experience, Dr. Hoyne sums up his conclusions as follows:

"There is no reliable method for the prevention of poliomyelitis. There is no form of serum whose efficiency has been proved in treating the patient during the acute stage. Hospitalization is advisable for purposes of isolation and treatment. Rest is imperative during the acute stage and is often essential for prolonged periods. Appropriate means for the prevention of deformities is of the utmost importance in every case no matter how slight the paralysis may seem to be. After-care is often of as great consequence to the patient as is early diagnosis.

The services of an orthopedic surgeon should be available for every poliomyelitic patient. In the past 20 years scientific investigation has produced nothing of practical value in the prevention or treatment of poliomyelitis."

BARBOUR, Peoria, Ill.

WHOOPING COUGH: DIAGNOSIS AND PREVENTION. L. SAUER, Illinois M. J. **72**:239 (Sept.) 1937.

Sauer discusses the diagnosis of whooping cough and efforts at prophylaxis with Bacillus pertussis vaccine (Sauer). He reports his observations on some 3,000 infants and children in whom injection of the vaccine had been performed under his supervision. His conclusion is that earlier diagnosis, earlier quarantine and three weekly preventive inoculations with authorized vaccine should decrease the incidence of whooping cough.

BARBOUR, Peoria, Ill.

DIPHTHERIA PREVENTION. N. C. BULLOCK, Illinois M. J. **72**:257 (Sept.) 1937.

Bullock points out that since several of the larger cities of Illinois have adopted the prevention of diphtheria as a major part of their program for public health, the morbidity and mortality from the disease in the state as well as in the individual cities have been lowered. After a study of the various methods used in the several cities, the author has concluded that the problem of the prevention of diphtheria in any community is an individual one. Smaller communities will do well to adhere to well established methods of active immunization and allow the larger metropolitan centers and institutions to do the pioneer investigative work with the newer immunizing agents.

BARBOUR, Peoria, Ill.

THE CONTROL OF SMALLPOX IN AN UNVACCINATED SCHOOL POPULATION. FRANK S. NEEDHAM, Illinois M. J. **72**:262 (Sept.) 1937.

In the fall of 1935 a smallpox epidemic started in communities surrounding Oak Park, Ill. A survey of the school population of Oak Park showed approximately 70 per cent of the children to be unvaccinated. Under Needham's supervision the department of health at once took steps to protect citizens of Oak Park. Persons who had been exposed through contact were promptly quarantined or vaccinated. The first recognized smallpox developed in the village five months later. All pupils and persons employed in the schools which had been attended by patients were quarantined at their homes for sixteen days if they had not been recently vaccinated. Examinations of all pupils by school nurses and doctors were made daily. In all cases of reported chickenpox a check was made. All suspicious eruptions and rashes were investigated. Widespread publicity was given, and vaccination was given to every one possible. More than 25,000 vaccinations were made in the village. (The school population was 13,000 children.) In less than two weeks the reports of the department showed that the outbreak was well under control.

BARBOUR, Peoria, Ill.

INCLUSION BODIES IN MEASLES. J. BROADHURST, M. E. MACLEAN and V. SAURINO, J. Infect. Dis. **61**:201 (Sept.-Oct.) 1937.

In measles nigrosine-staining inclusion bodies may be demonstrated in the nasal membranes and in the Koplik spots in the buccal cavity. These inclusion bodies may be seen on the first day of the disease, but they seem to be uniformly present from the second day of the disease to at least the twelfth day. They are characteristic of measles and are not present in persons who do not have measles or other virus infections. The presence of such bodies is accomplished by definite

changes leading to erosion and disintegration of the host cells. Similar changes are seen in the lymphocytes present in the Koplik spots as well as in the white corpuscles of patients with measles.

TOOMEY, Cleveland.

PERSISTENCE OF IMMUNITY IN GUINEA PIGS IMMUNIZED WITH CALCIUM AND ALUM-PRECIPITATED DIPHTHERIA TOXOIDS. G. R. SICKLES, J. Infect. Dis. **61**:234 (Sept.-Oct.) 1937.

Although the number of guinea pigs in which observations were made was limited, the precipitated preparations of diphtheria toxoid used in these experiments apparently possessed well marked antigenic stability: After twelve months' exposure to varying room temperatures, with and without preservative, there was no loss of antigenicity.

The antitoxic titer of the blood of the guinea pigs immunized with one toxoid dropped more rapidly than that of the blood of the guinea pig immunized with the other two preparations. Despite this drop in their antitoxin, the animals did not react to the intracutaneous test for susceptibility.

The individual guinea pigs varied in the persistence of antitoxin in their blood after immunization, but all possessed well marked latent or active immunity after twelve months, as evidenced by a quick rise in antitoxin following the stimulus of a small intracutaneous dose of toxin.

TOOMEY, Cleveland.

LYOPHILE SERUM IN THE PREVENTION AND TREATMENT OF SCARLET FEVER AND IN THE PREVENTION OF OTHER INFECTIOUS DISEASES. A. C. MCGUINNESS, J. STOKES JR. and S. MUDD, Pennsylvania M. J. **40**:939 (Aug.) 1937.

Immune human serums have long been recognized to be of value in prophylaxis against certain of the infectious diseases of childhood. Convalescent scarlet fever serum likewise has been used for some time in the treatment of this disease. The use of human serums has been limited, however, by several factors, chief among which have been the lack of an available supply during periods of epidemics and the fact that such a supply cannot be harvested during one epidemic to be stored for future epidemics without considerable deterioration in the antibody content.

1. The lyophile process for the preservation of serums and other biologic products is briefly described. Serum so processed may be preserved over long periods and may be highly concentrated. Pooling is also facilitated.

2. The use of human serums preserved by this process in prophylaxis against, and treatment of, scarlet fever and in prophylaxis against measles, mumps and chickenpox has given results comparable in every way to those reported by other investigators who have employed fresh serums or serums preserved in the liquid state.

3. Reactions following the injection of lyophile serum are few, and serum reactions such as frequently follow the injection of horse serum have never been encountered.

LOGUE, Williamsport, Pa.

PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES. Pub. Health Rep. **52**:1369 (Oct.) 1937.

For the period from Jan. 1 to Sept. 18, 1937, there were 6,407 cases of poliomyelitis reported as compared to 2,036 and 7,278 for similar periods in 1936 and 1935, respectively. The current epidemic started in the west south central region and spread to the north central region. The incidence of measles for the four weeks ending September 11 was about 60 per cent above that of the corresponding period of 1936; that of smallpox continued high; that of meningococcic meningitis was average, while that of typhoid fever, that of scarlet fever, that of diphtheria and that of influenza were below average.

SANFORD, Chicago.

PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES. Pub. Health Rep. **52**:1519 (Oct. 29) 1937.

From Sept. 12 to Oct. 9, 1937, the incidence of poliomyelitis showed a decline. Altogether, to this date there were 8,450 cases reported in all sections, which is the largest number since 1931 with the exception of 1935. The west south central and north central regions were most affected.. The number of cases of influenza increased about 60 per cent; the incidence of smallpox of 231 cases was the highest since 1931, while that of measles and of meningitis was slightly higher than normal. The incidence of typhoid fever, of scarlet fever and of diphtheria was below normal. The average mortality from all causes was 10.4 per thousand, which is higher then the average for the last five years.

SANFORD, Chicago.

CASE REPORT: GENERALIZED CUTANEOUS VACCINIA. P. R. EVANS, Arch. Dis. Childhood **12**:333 (Oct.) 1937.

An account of generalized cutaneous vaccinia in an infant is given. The disease is uncommon; it may occur at any age and after primary, secondary or tertiary vaccination. It is commoner in the first half of the year than in the second. It may cause death in an infant. It may be transmitted by direct contact or by animal inoculation. The incubation period is similar to that of postvaccinial encephalitis. The disease probably arises through a failure of the patient to acquire cutaneous immunity. The treatment of infants with serum from a recently vaccinated person is advisable.

KELLY, Milwaukee.

THE USE OF ADULT SERUM IN MEASLES. KAYE LE FLEMING, Brit. M. J. **2**:612 (Sept. 25) 1937.

The author reports an epidemic of measles in a public school of 300 boys, aged from 13 to 18 years, in which treatment with adult serum was used.

Adult serum had a marked effect in attenuating the disease and in decreasing the incidence of complications. There was no evidence that temporary immunity resulted from the use of the serum. Early treatment of infection of the middle ear by incision of the drum will greatly reduce the risk of mastoid infection.

ROYSTER, University, Va.

CASE OF DIPHTHERIA OF VULVA. BOULOS SALIB, J. Egyptian M. A. **20**:402 (Sept.) 1937.

The author reports a case of diphtheritic vulvitis in association with diphtheritic tonsillitis in a 1 year old girl. Cultures of material from both the vulva and the tonsils showed Klebs-Löffler bacilli. Antitoxin was administered, and the child recovered.

MULHERIN, Augusta, Ga.

A CASE OF POST-VACCINAL MYELITIS. T. M. CLOUSTON and B. H. QUIN, M. J. Australia **2**:568 (Oct. 2) 1937.

The authors report a case of postvaccinial myelitis in a 9 year old girl, with onset five days after vaccination.

GONCE, Madison, Wis.

TREATMENT OF SCARLET FEVER WITH AZO DYES. A. FARIOLI, Méd. inf. **8**:291 (Sept.) 1937.

During 1937 prontosil (4-sulfamido-2', 4'-diaminoazobenzene hydrochloride, a derivative of sulfanilamide) was given to the children with scarlet fever at the children's clinic in Bologna. The clinical course was compared with that of patients observed during the two preceding years. Farioli concludes that these dyes were handled very well by the young patients with scarlet fever and that

some improvement followed its use, especially when there was severe angina. Prophylactic use of sulfanilamide and its derivatives in the control of epidemics of scarlet fever is recommended.

HIGGINS, Boston.

MENINGOCOCCIC SEPSIS IN AN INFANT, WITH COMPLETE CURE. N. CARRARA, Lattante **8**:564 (Oct.) 1937.

An infant of 3 months was first seen in the bacteremic phase of meningococcic infection; there was a purpuric eruption with signs of pulmonary metastases. The second phase was that of meningitis. It lasted for about one month. As the child was recovering from the meningitis, the third phase, that of multiple metastases in the joints, especially in the right knee, appeared. Two months after the onset of the infection the patient was completely well. Polyvalent meningococcic serum was used, although its efficacy in this case is doubted.

HIGGINS, Boston.

DIPHTHERITIC GASTROESOPHAGITIS IN A CHILD. G. SANPAOLESI, Riv. di clin. pediat. **35**:806 (Sept.) 1937.

Sanpaolesi reports a case of diphtheritic gastroesophagitis in an infant of 18 days. The child died of laryngeal diphtheria and bronchopneumonia. The postmortem examination showed diphtheritic membranes over the gastric and esophageal mucosa. Cultures of these membranes yielded diphtheria bacilli.

HIGGINS, Boston.

INFECTIOUS ERYTHEMA, OR FIFTH VENEREAL DISEASE (GRANULOMA INGUINALE). C. GIANELLI and M. E. MANTERO, Arch. de pediat. d. Uruguay **8**:414 (July) 1937.

During the past year these authors observed 11 patients showing symptoms typical of this rather rare disorder. Most of them were children attending the same school. Nine had previously had measles. Each showed typical lesions on the face and the extremities, and all made an uneventful recovery.

SCHLUTZ, Chicago.

APARALYTIC, MENINGEAL FORMS OF HEINE-MEDIN DISEASE. J. BONABA and R. CHARLONE, Arch. de pediat. d. Uruguay **8**:419 (July) 1937.

Aparalytic, meningeal forms of this disorder have been observed in practically every epidemic which has been observed in Uruguay. These forms are clearcut and generally benign. The patients usually recover without having residual involvements. They may have a more rapid development terminating in bulbar phenomena, and later may show symptoms of paralysis. During an epidemic, the meningeal symptoms, changes in the spinal fluid and Morquio's sign established the diagnosis. The latter sign is particularly valuable in identifying these forms. Early recognition of the condition is important.

SCHLUTZ, Chicago.

MORQUIO'S SIGN IN HEINE-MEDIN DISEASE: THE SIGN OF ROTATION. H. MOURIGAN, Arch. de pediat. d. Uruguay **8**:506 (Aug.) 1937.

Among other well known signs of Heine-Medin disease, the sign of rotation, a variant of Morquio's sign, is often observed. It consists in a rotation of the trunk or of the entire body to a lateral position when the patient is placed on the bed and the hand is placed under the flexed knees. It appears only if there is no paralysis of the inferior members. The rotation will take place to the right or to the left or to both sides, depending on the degree of involvement.

Hyperesthesia and this sign seem to begin simultaneously and run parallel. Actual presence of paralysis is not obligate for the appearance of this sign. Hyperesthesia and pain are the cause of both signs.

SCHLUTZ, Chicago.

PROPHYLAXIS AGAINST TRANSMISSIBLE DISEASES. L. BERLANGA BERUMEN, Rev. mex. de puericultura **7**:418 (Aug.) 1937.

The author discusses in particular, vaccination against smallpox, immunization against diphtheria and the use of the Pirquet tuberculin test in school children.

HERRON, Monroe, La.

VACCINE TREATMENT OF WHOOPING COUGH. S. WERNER, Jahrb. f. Kinderh. **146**:68 (Jan.) 1936.

The treatment of whooping cough with an emulsion of whooping cough bacilli was tried on 70 children, of whom 19 were infants. A certain effect may be expected in all cases. The effectiveness is less in the infants, probably because their ability to form antibodies is undeveloped.

Success depends on the earliest possible administration of the vaccine, but even if use of the vaccine is delayed a slightly favorable response may be expected.

A prophylactic effect has not been demonstrated.

LANDAU, Hannibal, Mo.

NONSPECIFIC REACTIONS IN CONVALESCENCE FROM DIPHTHERIA. F. WIDENBAUER and H. GERBA, Monatschr. f. Kinderh. **70**:313 (July) 1937.

During the last three years Widenbauer and Gerber saw 1,010 patients with diphtheria. In 28 per cent of these there was a rise of temperature in from twelve to twenty-two days after the first injection of serum. This occurred in 95 per cent of the patients with pharyngeal diphtheria and in none of those with nasal diphtheria.

As diphtheria carriers treated with serum showed these little exacerbations less frequently than the patients with active disease, the writers believe the causal factor to be in the diphtheria rather than in the serum.

GERSTLEY, Chicago.

RHEUMATISM AND CHOREA FOLLOWING DIPHTHERIA. H. G. HUBER, Monatschr. f. Kinderh. **70**:332 (July) 1937.

Huber reports 5 cases of diphtheria, in 3 of which swelling of joints developed, while in the other 2 acute chorea occurred, as complications. He reports these cases as evidence that diphtheria toxin can produce such syndromes as well as that of the streptococcus.

GERSTLEY, Chicago.

EMBOLISM OF THE ABDOMINAL AORTA AFTER DIPHTHERIA. D. BOBEFF, Monatschr. f. Kinderh. **71**:169 (Oct.) 1937.

This is a case report, with photographs showing gangrene of the feet as a complication of diphtheria. The pain at first led to a diagnosis of neuritis. The thrombus was found at postmortem examination.

GERSTLEY, Chicago.

EPIDEMIOLOGIC SIGNIFICANCE OF DIPHTHERIA BACILLUS CARRIERS AMONG IMMUNIZED AND NONIMMUNIZED CHILDREN. E. BENDER, München. med. Wchnschr. **84**:1062 (July 2) 1937.

The epidemic occurrence of an infectious disease depends to a great extent on the dissemination of the infecting agent. Of great importance in the spread of diphtheria are the carriers. There are more carriers during the winter than during other seasons of the year, and they are more numerous duing the periods of epidemics. It is impossible to isolate all diphtheria carriers.

It has been thought that persons who had been actively immunized would be more likely to become carriers than those not immunized. Bender examined

cultures of material swabbed from the throats of 2,793 school children for the presence of virulent bacilli after they had individually received three doses of toxoid. The cultures indicated that 0.82 per cent of these children were carriers of virulent bacilli. He also examined like cultures from 313 children who had not received immunizing injections, and in this group the incidence of such carriers was 11.18 per cent. Virulence was determined by streaking the swabs on Clauberg's tellurium mediums, incubating for from twenty-four to forty-eight hours and making a morphologic examination of suspicious colonies. Subsequently Bender states that half of those cultures which were considered virulent were found avirulent by the guinea pig test. However, he does not state how these carriers of nontoxin-producing bacilli were divided between the two groups he studied.

BRAHDY, Mt. Vernon, N. Y.

EFFECT OF INFECTION WITH DIPHTHERIA ON THE ANTITOXIN CONTENT OF BLOOD. KATHERINE FEJES, Orvosi hetil. **81**:130 (Feb. 6) 1937.

The author immunized guinea pigs with anatoxin and later examined them to find out whether artificial conjunctival diphtheria has any influence on the level of antitoxin in the blood during the first days of the illness. In 9 of 16 cases the infection was followed by a decrease in the antitoxin content, but in 3 cases there was a decided increase. No connection between the increase or decrease of the antitoxin content and the severity of the illness could be demonstrated.

GÖTTCHE, Budapest, Hungary.

Acute Infectious Diseases

PASTEURIZED VERSUS RAW MILK IN UNDULANT FEVER. J. I. WEISMAN, New England J. Med. **216**:977 (June 3) 1937.

In January 1930, 243 patients and employes of Essex Sanatorium were examined, and 38 (15.2 per cent) were found whose blood contained agglutinins, the titers of which varied from 1 : 15 to 1 : 405.

There was little delay in insisting on pasteurization of the milk supply. In July 1932, Weisman made tests on the blood of 312 persons. None showed agglutination in dilutions ranging from 1 : 25 to 1 : 200. Included in this group were 23 patients whose blood formerly gave agglutination.

The conclusions are obvious. Pasteurization is effective in the prevention of infection through milk from cows with contagious abortion.

From 1924 to 1929 milk-borne epidemics in this country resulted in the illness of 10,906 persons and the death of 371. Nor is the problem of pasteurization peculiar to the United States. Lord Moynihan pointed out that, of 3,250,000 cows in England, 1,000,000 were tuberculous, and while he urged increased use of milk, he insisted that it be bacteriologically clean. D. Arnold Netter of Paris warned of the spread of undulant fever and stated that pasteurization is effective so far as cow's milk is concerned. Goat's milk will not stand sterilization and if infected should not be sold.

GENGENBACH, Denver.

COMMENTS UPON CERTAIN ASPECTS OF RHEUMATIC FEVER AND RHEUMATIC HEART DISEASE. L. A. CONNER, New England J. Med. **217**:503 (Sept. 23) 1937.

There are three well defined periods in the development of an attack of rheumatic fever. The first is that of an acute infection of the upper part of the respiratory tract, usually lasting but a few days. The second a period during which the disease is latent or quiescent, lasting from several days to several weeks. The third is the period of active rheumatic manifestations. Yet it is the everyday experience to see children who have repeated attacks of tonsillitis and nasopharyngitis year after year with never a rheumatic manifestation at any time.

A feature which has been receiving increasing attention is the strong tendency of the disease to appear in several members of the same family. Does this represent familial susceptibility, or is it merely the result of close contact and direct transmission, as has been suggested? A good many epidemics of infection of the upper part of the respiratory tract by the hemolytic streptococcus are recorded in which no one of the affected persons has acquired rheumatic fever. It seems probable that the pronounced tendency of rheumatic fever to appear in more than one member of a family indicates some familial lack of natural protection against it.

In the search for the causative agent of rheumatic fever, interest has shifted sharply from the nonhemolytic to the hemolytic group of streptococci, and a formidable amount of evidence is being assembled to indicate that infections of the throat by the hemolytic streptococcus are the usual, if not the regular, antecedent of the clinical manifestations of this disease.

The cleancut arthritic attacks usually seen in adults are infrequent in children, in whom they are replaced by protracted or recurrent febrile periods, indistinct symptoms of disease of the joints and cardiac manifestations of various sorts.

GENGENBACH, Denver.

LUNG CHANGES IN INFLUENZA. J. G. SCADDING, Quart. J. Med. **6**:425 (Oct.) 1937.

A clinical and bacteriologic study was made of 58 persons with influenza admitted to the Hammersmith Hospital, London, in December 1936 and January 1937. From 4 of these patients the influenza virus was isolated.

Bacteriologic studies of the sputum revealed that the bacterial flora of the sputum of the patients with influenza was not different from that of the sputum of noninfluenzal patients examined during the period of the epidemic. Pneumococci, which were absent in the group without pulmonary involvement, predominated in those with pneumonic consolidation.

Roentgenograms showing the typical basilar lesions of the lungs are appended.

BRADFORD, Rochester, N. Y.

TETANUS IMMUNIZATION WITH ALUM-PRECIPITATED TOXOID. A. MCBRYDE, South. M. J. **30**:565 (June) 1937.

McBryde feels that tetanus toxoid is of special value in children who are allergic. With the widespread vogue, and perhaps necessity, of giving antitoxin for the most trivial wounds, it may be a good procedure to immunize children against tetanus as a routine. Present knowledge would indicate that two injections of alum-precipitated tetanus toxoid should be given at an interval of two months, followed by a third injection at the time of injury. This would be sufficient to protect the child. This would raise the serum antitoxin to the level reached on injection of 1,500 units of antitoxin.

SCHLUTZ, Chicago.

PERNICIOUS MALARIA IN CHILDREN. J. P. PRICE, South. M. J. **30**:991 (Oct.) 1937.

The advisability of giving quinine to malarial patients with hemoglobinuria is controversial. If the hemoglobinuria is due to malaria, which it undoubtedly is, quinine appears to be indicated. On the other hand, the use of the drug has been reported to cause either further paroxysms or anuria. Price suggests a compromise method of treatment.

As soon as the diagnosis is established, a small dose (5 grains [0.32 Gm.]) of quinine is given intramuscularly. A specimen of urine is examined after each voiding, and the total output is recorded. In the meantime, fluids are given parenterally and, if possible, a blood transfusion.

If at the end of twenty-four hours no deleterious effects of the quinine have been noted (suppression of urination or increased hemoglobinuria), another 5 grains is given intramuscularly. This is repeated daily until the urine is normal or until quinine can be taken by mouth.

SCHLUTZ, Chicago.

DYSENTERY IN INFANCY. I. A. SABRI, M. A. ABBOUD and M. ALI, Arch. Dis. Childhood **12**:225 (Aug.) 1937.

Bacillary dysentery is a self-limited disease in which recovery depends on the development of immunity on the part of the body. Until such immunity has developed, the disease will continue on its course irrespective of the character of the diet. The underlying principles of treatment should be to choose a diet that maintains nutrition until the body has developed sufficient resistance to overcome the infection. The value of the various diets in maintaining resistance at this point has already been considered. The sigmoidoscope can be safely used in infancy. It affords a rapid and accurate means of diagnosis of dysenteric conditions. The course of the disease can be closely followed and the onset of final cure definitely established.

KELLY, Milwaukee.

A COMPARATIVE STUDY OF THE FORMATION OF ANTIBODIES IN THE SERUM OF PERSONS TREATED WITH THREE TYPES OF TYPHOID VACCINE. W. LEWIN, J. H. S. GEAR and D. LANDAU, South African M. J. **11**:629 (Sept. 25) 1937.

The authors state that no persons receiving endotoxoid vaccine were reported ill, whereas 15 per cent of those inoculated with typhoid bacteria in suspension lost working days. No untoward effects were observed after the oral administration of typhoid vaccine pills. Both the typhoid endotoxoid vaccine and the suspension of typhoid bacteria, given subcutaneously, produced H and O agglutinins to high titers and stimulated the production of complement fixators. Orally administered typhoid vaccine stimulated the production of antibodies in the blood serum in only a small number of persons and in most of these to a low titer.

GONCE, Madison, Wis.

SIGNIFICANCE OF GASTRIC HEMORRHAGES IN THE COURSE OF INFECTIONS IN INFANTS. L. RIBADEAU-DUMAS and S. LOEWE-LYON, Bull. Soc. de pédiat. de Paris **35**:187 (March) 1937.

During a period of six months only 4 infants with severe infections had hematemesis. Seventeen children with hematemesis were encountered in the pediatric service of Salpêtrière. This condition is usually accompanied by marked mental symptoms of a toxic type. The prognosis is invariably bad, and death ensues after a short time. The explanation of the hematemesis is that it is probably due to a toxic vasomotor disturbance, as experimentally hemorrhages of the stomach as well as of the other viscera have been produced by injury to vasomotor pathways.

BENJAMIN, Montreal, Canada.

THE CONGO RED TEST OF ADLER AND REIMANN IN SOME INFECTIOUS DISEASES OF CHILDREN. I. GATTO, Méd. inf. **8**:280 (Sept.) 1937.

The congo red test depends on absorption of the dye from the blood stream. Normally between 30 and 50 per cent of the dye is absorbed in one hour. A low absorption of the dye suggests abnormality of the reticuloendothelial system.

Gatto made observations on 42 children, 8 of them normal. In those with pulmonary tuberculosis, typhoid fever or abdominal leishmaniasis the absorption was diminished. In those with cutaneous leishmaniasis it was normal. Improvement of the patient's condition, as following pneumothorax for tuberculosis or the giving of specific treatment for leishmaniasis, was accompanied by a return

to normal of the absorption of congo red. The results of simultaneous determinations of the sedimentation rate and of the congo red absorption showed no parallelism.

HIGGINS, Boston.

MORTALITY FROM RHEUMATIC FEVER IN CHILDHOOD. J. M. MACERA and G. COSTA BERTANI, Arch. argent. de pediat. **8**:634 (July) 1937.

Macera and Costa Bertani call attention to the incidence of rheumatic fever in children of Argentina. In 1934 this disease caused 920 deaths. Only recently have public health authorities created centers for the care of children affected with rheumatism and with the carditis resulting from it. The great benefits and good results obtained in such centers are described, and the importance of prophylaxis is pointed out. The hope is expressed that such a center may become a part of every pediatric outpatient department.

SCHLUTZ, Chicago.

A CASE OF CARDIAC RHEUMATISM WITH ICHTHYOSIS. F. DE LA TORRE, Rev. mex. de puericultura **7**:371 (Aug.) 1937.

De la Torre reviews the etiology of rheumatic heart disease and presents a case in which there was an associated icthyosis.

HERRON, Monroe, La.

THE TETANUS PROBLEM. L. VON BAKAY and D. VON KLIMKÓ, Beitr. z. klin. Chir. **161**:574, 1935.

Out of their vast experience, the authors have made the following recommendations:

1. The farmers must be enlightened as to the fact that serious complications may occur in wounds of the extremities. This does not depend on the extent of the lesions or on the amount of suffering from the wounds, but on the degree of possibility of infection. To minimize this possibility, wounds should be thoroughly cleansed and foreign bodies removed.

2. Because the majority of wounds occur in the region of the feet and toes, it is important not to work or run around barefoot. This statement is especially applicable to children. If the advice is followed there will be 50 per cent less chance of involvement.

3. Prophylactic immunization is important. Serum must always be at the disposal of the physician, especially in farming regions.

4. Quick and thorough treatment with serum is essential in cases of tetanus. Hospitalization is always advised.

RUBIN, Boston.

INFECTIOUS DISEASES IN INFANTS. H. RIETSCHEL, Med. Klin. **33**:1021 (July 30) 1937.

Immunity of the newborn against such diseases as measles, diphtheria, varicella and scarlet fever is passive; i. e., it is due to transfer of immune bodies from the mother during fetal life.

"Immunity" against other diseases is less simple. Inability to react to infection is characteristic of embryonic and fetal tissues. Even in the newborn, ability to form antibodies is incompletely developed. For this reason there is less likelihood of localization and more likelihood of an invasion of the blood stream. Sepsis may be unaccompanied by severe symptoms, yet prove rapidly fatal. Tuberculosis and syphilis are frequently devastating in the newborn. Diseases depending on antibody formation for their development, especially those that possibly have an allergic basis, as rheumatism and chorea, are not encountered in the newborn.

Limited capacity for the formation of antibodies also accounts for the unreliable results of vaccination in newborn and in very young infants.

SIEMSEN, Chicago.

PNEUMOCOCCIC INFECTION IN CHILDHOOD. G. MÜLLER, Monatschr. f. Kinderh. **70**:354 (July) 1937.

In 147 cases of pneumococcic infection, evidenced by such conditions as empyema, otitis, meningitis, peritonitis and conjunctivitis, Müller found the type I pneumococcus in 61, or 41 per cent. Group X played some role in the infections of the lungs, but in 74 per cent of all cases of empyema the etiologic agents were the fixed types. Group X occurred in 14 of 18 cases of meningitis and in over half of the cases of otitis while type III was found in about one third. Type I occurred in all 3 cases of peritonitis, while in the cases of conjunctivitis the organisms belonged chiefly to group X.

GERSTLEY, Chicago.

AN EPIDEMIC OF INFECTION WITH LEPTOSPIRA CANICOLA IN MEN AND DOGS. C. J. ROOS, B. WALCH-SORGDRAGER and W. P. A. SCHÜFFNER, Nederl. tijdschr. v. geneesk. **81**:3324 (July 10) 1937.

This is a description of a second case of leptospirosis resembling meningitis, caused by Leptospira canicola. The cause of the infection was with high probability a young dog (Samoyed), which belonged to a litter of which all the puppies appeared to be infected with L. canicola. Two of the other persons who had been in close contact with the dogs also had been infected with L. canicola, as appeared from their serologic reactions; also another dog, which had for some days been in the company of two of the infected ones, proved to be infected. The infection was introduced by the father of the dogs and went via the mother to the puppies and from them to 3 persons and another dog. One of the infected persons showed symptoms greatly resembling those of meningitis; in the other ones the condition had been looked on as influenza. L. canicola was cultured from the urine of 1 of the patients and from that of 4 dogs; it proved to be more virulent than was usual. None of the 9 infected animals was seriously ill.

VAN CREVELD, Amsterdam, Netherlands.

Chronic Infectious Diseases

TREATMENT OF PRIMARY TUBERCULOSIS IN CHILDHOOD: ITS ROLE IN PREVENTION OF LATER STAGES OF THE DISEASE. ROBERT DEBRÉ and MARCEL LELONG, Bull. Soc. de pédiat. de Paris **34**:661 (Nov.) 1936.

The importance of rest in bed for children who have recently acquired tuberculous infection is stressed. In addition to being held to the usual details of an antituberculosis regimen, the child should be carefully observed clinically and roentgenologically and should be kept completely at rest until all symptoms and signs have cleared. When the reaction to the tuberculin test has recently become positive and the child shows no symptoms of illness and no roentgenologic abnormality, a period of three months in bed, followed by gradual return to normal activity during the next three months is advised; after erythema nodosum six months of rest in bed is recommended, and after a pleural effusion, one year.

BENJAMIN, Montreal, Canada.

DIAGNOSIS BETWEEN PRIMARY HILAR TUBERCULOSIS AND HILAR PNEUMONIA. G. MOURIQUAND and J. SAVOYE, Bull. Soc. de pédiat. de Paris **34**:669 (Nov.) 1936.

Roentgenologic evidence in the form of hilar shadows is not pathognomonic of tuberculosis, although it is frequently due to this disease. Pneumococcic infection may produce hilar shadows, and it is important to differentiate pulmonary conditions of such origin from those of similar appearance due to tuberculosis. The former clear more rapidly. It is said that the degree of reaction to the tuberculin

test may be of assistance, as it may be mildly or moderately but never strongly positive, as indicated by vesiculation at the site of the test, in cases of pneumococcic infection. Inoculation of guinea pigs, as well as examinations of sputum and of stools for tubercle bacilli, should be done. The authors state that, in the absence of any expectoration, sputum for examination may be obtained by placing the child in the position of postural drainage for ten or fifteen minutes.

BENJAMIN, Montreal, Canada.

FUTURE OF PRIMARY TUBERCULOUS INFECTION AND ITS DIFFERENTIATION FROM HILAR PNEUMONIA. P. F. ARMAND-DELILLE, Bull. Soc. de pédiat. de Paris **34**:674 (Nov.) 1936.

The prognosis of tuberculosis in childhood depends on the intensity of the infection, the age at which it is acquired and the completeness of its treatment. The case of a girl 3 years old is cited to illustrate the difficulty sometimes encountered in differentiating between tuberculous and pneumococcic infection. What was at first thought to be interlobar empyema later proved to be tuberculous infiltration which went on to cavitation.

BENJAMIN, Montreal, Canada.

FACTORS IN PROGNOSIS OF PRIMARY TUBERCULOUS INFECTION IN CHILDREN UNDER THREE YEARS OLD. L. GAROT, BALLET and J. SCHAAPS, Bull. Soc. de pédiat. de Paris **34**:676 (Nov.) 1936.

Of 1,764 children under 3 years old observed in a clinic in Liège, Belgium, from 1927 to 1936, 82 (4.6 per cent) showed a positive reaction to the tuberculin test, and 14 (0.8 per cent) had a doubtful reaction. In 33 tuberculosis was rapidly fatal. Two thirds of the deaths were due to generalized tuberculosis. When the primary infection was not accompanied with any other lesion, the child survived. The patients who died were infected at an earlier age, and more of them than of those who survived lived in homes with persons who had severe open tuberculosis. All who showed chimney-like paratracheal shadows on roentgenologic examination died.

BENJAMIN, Montreal, Canada.

REMOTE PROGNOSIS AND TREATMENT OF PRIMARY-SECONDARY TUBERCULOSIS IN ADULTS. E. VAUCHER, Bull. Soc. de pédiat. de Paris **34**:683 (Nov.) 1936.

Male and female students entering a university were given tuberculin tests, and one third were found to react positively. The outlook was good, as in most cases the primary infection was mild. Even in cases in which the involvement is mild, interruption of studies for at least eight months and gradual return to normal activity thereafter are recommended, as well as careful clinical and roentgenologic observation for two or three years. Treatment by surgical means or pneumothorax is not advised for acute involvement, and thoracentesis for pleural effusion should be performed as rarely as possible.

BENJAMIN, Montreal, Canada.

COURSE OF TUBERCULOSIS IN EARLY LIFE IN A CITY. G. DREYFUS-SÉE, Bull. Soc. de pédiat. de Paris **34**:685 (Nov.) 1936.

It is stated that as a general rule infants with tuberculosis do about as well in an urban center as in the country. In selected cases, when the disease does not recede properly while the infant is in the city, transfer to the country may be advisable, but such a transfer is not considered necessary as soon as a diagnosis of tuberculosis is made. A few cases observed clinically and roentgenologically are cited to support this view.

BENJAMIN, Montreal, Canada.

REMOTE ROENTGENOLOGICALLY VISIBLE SEQUELAE OF PRIMARY GLANDULAR AND PULMONARY TUBERCULOUS INFECTIONS AND THEIR DIAGNOSIS. J. GÉNÉVRIER, Bull. Soc. de pédiat. de Paris **34**:691 (Nov.) 1936.

It is stated that a child who once shows a positive reaction to the tuberculin test has never been observed to react negatively to the test thereafter. Non-tuberculous acute and chronic diseases of the respiratory tract may leave cicatricial sequelae such as calcified glands, and a persistently negative reaction to the tuberculin test rules out the possibility of tuberculosis as the etiologic factor.

BENJAMIN, Montreal, Canada.

ROENTGENOLOGIC APPEARANCES OF INTRATHORACIC CALCIFICATIONS IN CLINICALLY HEALTHY ADOLESCENT PERSONS. M. PÉHU and MEERSSEMAN, Bull. Soc. de pédiat. de Paris **34**:693 (Nov.) 1936.

Young soldiers entering the army and students admitted to the military school of public health were examined roentgenologically. In four years 17,800 subjects between the ages of 18 and 22 years were observed. From 0.64 to 8.3 per cent of each annual group were found to have intrathoracic calcification, i. e., pulmonary, glandular or pleural. The higher figures are believed to have resulted from the use both of roentgenograms and of fluoroscopic examination and the lower figures from fluoroscopic examination alone. All the subjects were healthy and showed no clinical evidence and no symptoms of tuberculosis. In most cases no definite date of infection could be established, and cicatrization had taken place during a latent period.

BENJAMIN, Montreal, Canada.

WHAT IS FATE OF CHILDREN WHO PRESENT PRIMARY TUBERCULOUS LESIONS IN EARLY CHILDHOOD? C. COHEN and E. SCHELLINCK, Bull. Soc. de pédiat. de Paris **34**:694 (Nov.) 1936.

In 2 children who received tuberculous infection from extrafamilial sources the disease was arrested, whereas 3 who were infected by members of their own families did not do well. One of the latter group had Pott's disease, and the other 2 died of generalized tuberculosis. A sixth child died, but the source of infection was not definitely ascertained.

BENJAMIN, Montreal, Canada.

METHOD OF "SUPERVISED FAMILY PLACEMENT" IN COMBATING TUBERCULOSIS IN CHILDHOOD: RESULTS OBTAINED AT CENTER IN THOREY. J. PARISOT and L. CAUSSADE, Bull. Soc. de pédiat. de Paris **34**:697 (Nov.) 1936.

During eight years over 200 children were removed from homes where one or both parents or a close relative had tuberculosis. They were placed in foster homes in the country, which were carefully selected and carefully supervised. As a result, children who were not infected when placed did not become infected, and those who had already been infected were in an environment in which the disease was arrested and the possibility of exogenous reinfection was removed. The results obtained were uniformly good.

BENJAMIN, Montreal, Canada.

DEVELOPMENT DURING EARLY LIFE OF CHILDREN BORN OF TUBERCULOUS PARENTS. R. DUTHOIT and R. DUBOIS, Bull. Soc. de pédiat. de Paris **34**:708 (Nov.) 1936.

One hundred and fifteen children were observed for six years. The disease developed in none of those who were removed from contact with their tuberculous parents, whereas among those who remained in a contaminated environment there was an appreciable morbidity as well as mortality from tuberculosis, even though careful precautions were taken.

BENJAMIN, Montreal, Canada.

DIET AND TUBERCULOSIS. G. MOURIQUAND, Bull. Soc. de pédiat. de Paris **34**:711 (Nov.) 1936.

Guinea pigs given a diet deficient in vitamin C and those given an adequate diet suffered infection with similar doses of tubercle bacilli, but guinea pigs of the latter group lived longer and showed some fibrous lesions. Apparently an adequate diet as compared with a diet deficient in vitamin C retards the course of tuberculous lesions.

BENJAMIN, Montreal, Canada.

PROPHYLAXIS AND TREATMENT OF PRIMARY INFECTION IN CHILDHOOD. P. F. ARMAND-DELILLE, Bull. Soc. de pédiat. de Paris **34**:712 (Nov.) 1936.

A previously expressed view of the efficacy of the Grancher system of placement of tuberculous children is confirmed. Immediately after a primary infection, the child is kept in bed for three months, after which placement in a preventorium and then in a sanatorium is arranged. The author voices a preference for high altitudes. Careful observation for three years is maintained, and then the child is returned to his parents, who are advised to have him live in the country; when this is not possible he attends an open air school.

BENJAMIN, Montreal, Canada.

INDICATIONS FOR TREATMENT IN PREVENTORIUMS AND SANATORIUMS IN COURSE OF PRIMARY-SECONDARY TUBERCULOSIS IN CHILDHOOD. P. LOWYS, MARINET and L. H. LAFAY, Bull. Soc. de pédiat. de Paris **34**:714 (Nov.) 1936.

Children are admitted to a preventorium only after a careful search of sputum, gastric contents and stools fails to reveal tubercle bacilli. Those in whom tubercle bacilli have been demonstrated are placed in sanatoriums. A number of thoracic roentgenograms are reproduced to show that no definite conclusion can be formed merely by roentgenologic examination as to whether the child is expelling tubercle bacilli.

BENJAMIN, Montreal, Canada.

IMPORTANCE OF SCHOOL FOR DISCOVERY OF PRIMARY TUBERCULOUS INFECTION. MAURICE FREYSS, Bull. Soc. de pédiat. de Paris **34**:725 (Nov.) 1936.

In children of school age, primary tuberculous infection is observed most frequently between the ages of 6 and 7 years and the ages of 12 and 14 years. A few cases in which the condition has been observed for many years extending into adult life are cited, and the conclusion is reached that in children of school age who acquire a primary tuberculous infection there is a strong tendency for the disease to be arrested.

BENJAMIN, Montreal, Canada.

CASE OF PRIMARY INFECTION AT PUBERTY, ARRESTED BY TREATMENT IN A SANATORIUM. ANDRÉ ZILLHARDT, Bull. Soc. de pédiat. de Paris **34**:728 (Nov.) 1936.

A febrile illness developed in a girl 11 years old. She presented no positive physical indications of tuberculosis. A tuberculin test produced a positive reaction, although three years and again one year previously she had reacted negatively to the test. A roentgenogram of the chest showed pulmonary and glandular shadows. She was sent to the children's sanatorium at Leysin, France, where she spent eight months. When she was observed two years later, the lesions had completely cleared. The case illustrates the importance of tuberculin tests and of roentgenologic examination, especially in the absence of clinical signs of the disease.

BENJAMIN, Montreal, Canada.

General Meteorologic, Orographic and Hygrometric Conditions in Climatotherapy of the Tuberculous Child; Permeable or Impermeable Soils; Good or Bad Humidity of Climates. Albéric Boudry, Bull. Soc. de pédiat. de Paris **34**:729 (Nov.) 1936.

No definite recommendations are made. Careful observation of the individual child during the first weeks of his stay under certain climatic conditions and careful measurement of these so far as possible should determine the conditions which are favorable or unfavorable for him.

Benjamin, Montreal, Canada.

The Typhobacillosis of Primary Tuberculosis and Its Diagnostic Value in Detecting Tuberculosis in Childhood. A. Wallgren, Rev. belge de puériculture **2**:47 (June) 1937.

Attention is called to the identity of the clinical picture of typhobacillosis as described by Landouzy and the morbid symptoms that make primary tuberculous infection manifest. In most cases of childhood infection there is a period of fever, often high fever, lasting from one to three weeks or longer, with no additional signs revealed by bedside examination other than a positive reaction to tuberculin and sometimes an eruption of erythema nodosum. In such cases the roentgenogram usually reveals pathologic shadows in one or both hili, and tubercle bacilli are demonstrable in the gastric lavage water. Experiments on animals have proved that in the early stages of tuberculous infection tubercle bacilli always spread from the site of inoculation by the lymphatics into the circulating blood, and a number of clinical observations suggest that there is a like bacillemia in human beings, at least during the stage of manifestation of primary tuberculous infection. Miliary tuberculosis develops most frequently at this time. In order to prevent overlooking manifest primary tuberculosis it is recommended that the physician test all children suffering from febrile diseases with tuberculin and submit all reactors to a roentgenoscopic examination. Wallgren, Göteborg, Sweden.

Congenital Syphilis in the City of Naples. E. Tatafiore, Lattante **8**:186 (April) 1937.

Tatafiore has gathered statistics on 18,360 infants seen in the wards and dispensary of the Ospedale Infantile "Pausilipon" of Naples between 1926 and 1936. Congenital syphilis was found in 3,475 infants, or 18.9 per cent. Syphilitic mothers reported an average of 4.5 pregnancies while nonsyphilitic mothers reported an average of 4.25 pregnancies. The incidence of twin pregnancies in syphilitic mothers was 4.95 per cent, whereas in nonsyphilitic mothers it was but 1.25 per cent. The abortions, stillbirths and premature births accounted for 14.2, 15 and 12.5 per cent of all pregnancies in syphilitic mothers, whereas in nonsyphilitic mothers the corresponding percentages were 2.5, 1.5 and 1.

Congenital syphilis was found in high percentage in the following clinical conditions: various congenital malformations, 70 per cent; endocrinopathy, 55 per cent; facial paralysis, 50 per cent; infantile encephalopathy, 58 per cent; spastic paralysis, 72 per cent; epilepsy, 65 per cent; craniotabes, 70 per cent; precocious rickets, 23 per cent, and tuberculous osteoarticular infections, 28 per cent.

In Italy syphilis is the factor most largely responsible for prenatal and natal mortality. It plays an important role in the depopulation of Italy.

The diffusion of information regarding syphilis, the examination of persons before marriage, the intensive treatment of pregnant women with syphilis and the creation of free evening clinics for syphilis are recommended.

Higgins, Boston.

Occurrence of Icterus in the Course of Secondary Syphilis. A. Bascunan E., Rev. chilena de pediat. **8**:371 (June) 1937.

Bascunan reports 2 cases in a child of 8 years and a youth of 14, both afflicted with syphilis in the secondary stage. In both icterus developed, accompanied by fever and gastrointestinal symptoms, following from six to eight injections of neoarsphenamine and bismuth preparations. The opinion is advanced that in these patients the treatment with the heavy metals increased an already existing hepatic damage due to the syphilis and produced a catarrhal form of icterus.

Schlutz, Chicago.

Meningeal Reactions in Children with Erythema Nodosum. I. Móritz, Orvosi hetil. **81**:677 (June 26) 1937.

Móritz states that clinical signs of meningeal irritation are often found in children with erythema nodosum, without any alterations of the cerebrospinal fluid except that the pressure is sometimes increased. During experiments with the allergometric procedure of Groer, after intracutaneous injections of tuberculin he likewise observed meningeal symptoms in 3 children, which disappeared in a few days. He considers that these symptoms were due to hyperemia caused by tuberculotoxic allergy.

Göttche, Budapest, Hungary.

The Prognosis for Occult Tuberculosis in Children: A Follow-Up Investigation of Children Whose Reactions to the Tuberculin Were Positive and of Children Whose Reactions Were Negative. G. Herlitz, Acta pædiat. (supp. 2) **19**:1, 1937.

This monograph of 157 pages contains an account of an investigation carried out to answer the following question: Is the child whose only manifestation of tuberculous infection is a positive Pirquet reaction more apt or less apt to sicken and die of tuberculosis than a child of comparable age whose reaction is negative? The study was based on examinations of 1,457 children under 15 years of age, most of whom were clients of the Uppsala University Children's Clinic. The patients were of the Swedish working class. About half of the children had reacted positively and the other half negatively. Follow-up examinations were made at intervals of from five to twenty-three years after the original visits to the clinic; the average interval was thirteen and four-tenths years. These patients were selected by reference to the earlier records. Follow-up data were obtained on 97.2 per cent of them. Half of them were given a follow-up physical examination and a roentgen examination of the chest.

Laborious statistical calculations were necessary to make it possible to draw conclusions from the results of the survey. These calculations are described and explained in detail. The following conclusions are drawn:

1. A child of the Swedish working class who exhibits a positive reaction to the Pirquet test but who shows no other evidence of tuberculous infection is more apt to manifest active tuberculosis and possibly to die of it within the next fifteen years than is a child of comparable age whose reaction is negative. This hazard exists for young men and young women as well as for children.

2. With reference to good health and survival through the second and third decades of life, it is distinctly less favorable to have been infected with tuberculosis during childhood than at a later period.

An additional interesting observation is communicated, to wit, that in 335 children whose reaction to the Pirquet test was positive and who were retested at the end of intervals of from three to twenty-three years, the reaction remained positive.

McCune, New York.

THREE CASES OF ACTINOMYCOSIS OF THE LUNGS. K. SÖNDERGAARD, Hospitalstid. **80**:801 (July 6) 1937.

Two of the patients were children 16 and 13 years of age. The first one was a girl who fell ill with symptoms of pleural irritation in May 1934. After temporary improvement, she was admitted to the hospital in September 1934 because of fever. She had then physical and roentgenologic signs of pleural involvement on the right side. The tuberculin test was negative. She showed slight anemia and neutrophilic leukocytosis. Some weeks later there developed a swelling on the right side of the thorax, corresponding to the eleventh and twelfth ribs. The swelling suppurated, and in the pus Actinomyces was demonstrated. The disease progressed, and the girl died one and a half years after the onset of the disease. The second patient was a boy who had a fistula from a dental abscess. One and a half years later he was treated with Finsen rays, and the fistula healed. At this time there were signs of involvement of the right pleura. The Pirquet test was negative. He showed neutrophilic leukocytosis. Two months later a subcutaneous abscess developed at the right shoulder blade, containing actinomycetes. The disease progressed, and death occurred one-half year after the first demonstration of signs of pleuropulmonary disease.

WALLGREN, Göteborg, Sweden.

BOVINE TUBERCULOSIS IN MAN. A. LINDAU, Nord. med. tidskr. **14**:1200 (July 24) 1937.

Of 213 strains of tubercle bacilli cultured from different types of tuberculous lesions in man, 21 were found to be of bovine type. Of these cases of bovine tuberculosis, 7 were cases of pulmonary tuberculosis and pleurisy, 8 were cases of surgical tuberculosis and 3 were cases of tonsillar tuberculosis.

WALLGREN, Göteborg, Sweden.

EXAMINATION OF URBAN SCHOOL CHILDREN FOR TUBERCULOSIS. E. FORSGREN, Svenska läk.-tidning. **34**:292 (Feb. 19) 1937.

Of 4,378 school children, 703 were found to react to cutaneous tests, and, of these, 31 displayed roentgen changes in the chest that suggested need of treatment. The distribution of the incidence of tuberculous infection and tuberculous disease varied considerably. In one parish 230 of 805 children tested reacted positively (29 per cent), and none of them needed treatment for this disease. In an isolated parish 10 of 179 children tested reacted to tuberculin (6 per cent), and 4 of them needed hospitalization for tuberculosis. Forsgren emphasizes the valuable information obtained in tuberculin testing: It gives a starting point for examination of the family and detection of the sources of infection.

WALLGREN, Göteborg, Sweden.

CHRONIC MILIARY TUBERCULOSIS. S. HELLBERG, Svenska läk.-tidning **34**:639 (April 30) 1937.

A boy of 3½ years who had given a negative reaction to tuberculin was infected by his father in September 1935. He began to cough at the end of October. He was first examined on November 27. He then gave a positive reaction to tuberculin. The hilar shadows were increased; miliary tuberculosis of the lungs developed, with fever (maximum, 40 C. [104 F.]), splenomegaly and lymphoma of the neck. Tubercle bacilli were demonstrated in the gastric lavage water. The general state of health was bad. Two months later there was slow regression of the symptoms, and during one year the condition of the boy was somewhat better. Roentgenologic signs of pulmonary miliary tuberculosis were still present. Eventually the boy grew worse and died one and one-half years after the onset of the symptoms.

WALLGREN, Göteborg, Sweden.

TUBERCULIN. N. LANDORF, Svenska läk.-tidning **34**:643 (April 30) 1937.

Landorf tested 1,000 children suffering from different kinds of tuberculous disease with increasing doses of tuberculin (Mantoux test) in order to determine the degree of sensitivity under different conditions. In children with fresh primary tuberculosis the sensitivity to tuberculin was much greater (reactions with from 0.000001 to 0.1 mg.) than in children with a calcified primary complex (reactions with from 0.001 to 1 mg.). There was no noteworthy difference in children with recent primary tuberculosis with or without erythema nodosum. The sensitivity in children with tertiary pulmonary tuberculosis corresponded to that in children with the calcified primary complex; about 50 per cent reacted to 0.01 mg. of tuberculin. In children with miliary tuberculosis and tuberculous meningitis there was less sensitivity; 50 per cent reacted to 0.1 mg. of tuberculin and from 11 to 17 per cent reacted negatively to doses of tuberculin up to 3 mg. Children with tuberculosis of the joints and bones, serous pleurisy and tuberculous lymphoma of the neck showed a degree of sensitivity that was at a level between that in children with fresh and that in children with calcified primary tuberculosis. In 157 of 855 tuberculous children each of whom was examined with a single cutaneous or percutaneous test these tests were negative (21.8 per cent).

WALLGREN, Göteborg, Sweden.

EFFICIENCY OF THE TUBERCULIN PATCH TEST. G. ANZÉN, Svenska läk.-tidning. **34**:733 (May 21) 1937.

Of 1,636 infants and children aged up to 15 in whom the tuberculin patch test was negative 26 reacted positively to the intracutaneous test with 1 mg. of tuberculin. Only 2 of these children suffered from active tuberculous disease. The reliability of the patch test is somewhat less in older children.

WALLGREN, Göteborg, Sweden.

THE POSSIBILITY THAT CHILDREN SUFFERING FROM TUBERCULOUS LYMPHOMA AND JOINT AND BONE TUBERCULOSIS MAY TRANSMIT TUBERCULOUS DISEASE. N. MOGENS, Ugesk. f. læger **99**:788 (July 22) 1937.

Mogens states that 378 tuberculosis-free infants and children were cared for at a seaside hospital for surgical tuberculosis during an average period of 210 days without becoming infected by reason of the presence of the tuberculous children.

WALLGREN, Göteborg, Sweden.

TUBERCULOSIS AND DILATATION OF THE BRONCHUS. G. J. HUËT, Nederl. tijdschr. v. geneesk. **81**:3440 (July 17) 1937.

It is generally accepted that chronic pneumonia with dilatation of the bronchi in children should be sharply differentiated from pulmonary tuberculosis. In this paper 3 cases are mentioned in which the two conditions were associated. The way in which this association could be explained is discussed. The practical interest of the occurrence of these mixed infections is this, that even in cases of clinically certain bronchiectasis there is good reason to examine the sputum for tubercle bacilli.

VAN CREVELD, Amsterdam, Netherlands.

Diseases of Blood, Heart and Blood Vessels and Spleen

DECREASED FRAGILITY OF RED CELLS AFTER SPLENECTOMY. A. S. GORDON, W. KLEINBERG and E. PONDER, Am. J. Physiol. **120**:150 (Sept.) 1937.

The decrease in fragility (i. e., the increase in resistance to hypotonic mediums) of the red cells of the guinea pig after splenectomy is due to the fact that the

cells are able to attain a greater critical volume for hemolysis than the cells of the normal animal. The removal of the spleen is, accordingly, followed by a modification in the structure of the red cell envelop.

NOURSE, Cleveland.

THE "BLEAT MURMUR" AND ITS ASSOCIATION WITH FIBRINOUS PERICARDITIS. M. M. MALINER, Arch. Pediat. **54**:591 (Oct.) 1937.

Twelve cases of fibrinous pericarditis are presented. In each instance the author heard a peculiar high-pitched squeaky systolic murmur with a tonal quality not unlike the bleating of a lamb. The sound can easily be mistaken for an endocardial murmur, which may account for the fact that it has never been described before. The murmur is evanescent. It is noted at the apex and increases in intensity as the stethoscope approaches the axilla. In Maliner's opinion, the sound is produced by the vibrations of tense short fibrinous bands connecting the two pericardial layers, which react as if plucked with each ventricular contraction.

ORR, Buffalo.

MODERN CONCEPTS OF ANEMIA FROM THE CLINICAL STANDPOINT. E. B. KRUMBHAAR, Bull. New York Acad. Med. **13**:501 (Sept.) 1937.

In the light of recent advances in hematology, the clinical division of the anemias into primary and secondary becomes absolete. The primary form is simply anemia of unknown origin; the secondary form is merely anemia as a part of one or another symptom complex.

Krumbhaar submits a classification based on pathogenesis which, though not all embracing, sheds more light on the clinical picture than any in present use:

1. Anemia due mainly to disorders in the formation of erythrocytes
   - (*a*) Insufficient formation of erythrocytes in the bone marrow, usually giving rise to monocytic anemia (other forms: aplastic anemia, myelophthysic anemia, anemia due to physical injury, etc.)
   - (*b*) Defective formation: erythroblastic, spherocytic ovalocytic anemia, (sickle cell anemia, poikilocytosis, normochromic or hypochromic anemia, macrocytic anemia)
2. Anemia due mainly to loss of blood
   - (*a*) Hemorrhage from trauma
   - (*b*) Chronic or intermittent bleeding
   - (*c*) Bleeding from abnormal blood vessels or bleeding due to abnormality of the blood constituents (purpura, hemophilia)
3. Anemia due mainly to excessive destruction of blood
   - (*a*) Destruction by hemolytic micro-organisms, toxins, poisons, etc.
   - (*b*) Destruction secondary to defective formation
   - (*c*) Destruction of unknown nature (Lederer's anemia, Banti's anemia)

A detailed discussion of each group follows.

JAHR, Omaha.

NATURE OF THE FACTOR CONCERNED IN LOSS OF BLOOD COAGULABILITY OF BILE FISTULA RATS. J. D. GREAVES and C. L. A. SCHMIDT, Poc. Soc. Exper. Biol. & Med. **37**:43 (Oct.) 1937.

Rats with bile fistulas were found to have an increase in the coagulation time of the blood and a decrease in the prothrombin content of the blood. Crude extracts of vitamin K (prepared from alfalfa), which had proved effective in preventing the hemorrhagic syndrome in chicks, as well as a highly purified preparation of vitamin K (furnished by Dr. H. J. Almquist), were able to decrease the coagula-

tion time and increase the prothrombin content of the blood. A similar loss in blood coagulability and a concurrent decrease in prothrombin were seen in rats made icteric by ligation of their bile ducts. HANSEN, Minneapolis.

VARIATIONS IN THE FIRST HEART SOUND AND THE AURICULO-VENTRICULAR CONDUCTION TIME IN CHILDREN WITH RHEUMATIC FEVER. J. D. KEITH, Arch. Dis. Childhood **12**:217 (Aug.) 1937.

The relationship of the intensity of the first heart sound to the PR interval is discussed, and the experimental results of Dock are applied clinically to children with rheumatic heart disease of various degrees of severity. It is found that the PR interval can be predicted with a fair degree of accuracy by the intensity of the first heart sound. This is emphasized by the fact that in an investigation of 100 patients with rheumatic heart disease at this hospital it was found that 26 per cent had had PR intervals of 0.2 second or over at some time during a period of two years and that 52 per cent had had a PR interval of 0.18 second or more over the same period. In the past too much emphasis has been placed on heart murmurs in rheumatic carditis. In this communication evidence has been presented of the definite importance of heart sounds. The accentuated first sound of mitral stenosis is discussed, and it is suggested that the presence of this sign in the rheumatic child (provided the heart rate is not notably raised) is more valuable in the diagnosis of mitral stenosis than the middiastolic murmur.

KELLY, Milwaukee.

ACUTE MYELOID LEUKAEMIA IN ONE OF IDENTICAL TWINS. C. E. KELLETT, Arch. Dis. Childhood **12**:239 (Aug.) 1937.

Acute myeloid leukemia in one of identical twins is described. Kettett points out that this case raises certain clearcut issues that can be met best by the assumption that the condition arose as a result of the action of some external factor, specific, but of low infectivity. An analysis of the cases of leukemia observed in the Royal Victoria Infirmary over the past five years yielded information that tends to support such an assumption. KELLY, Milwaukee.

CONGENITAL ARTERIOVENOUS COMMUNICATIONS, WITH A REPORT OF TWO CASES. J. GILMOUR and M. BOLAM, Brit. J. Surg. **25**:337 (Oct.) 1937.

This syndrome is characterized by hypertrophy of the affected limb and usually by peripheral ulceration. Venous dilatation and pulsation accompany the condition and give the key to the correct diagnosis. There is an increase in the surface temperature of the affected part, which is not associated with elevation of the body temperature.

There is overgrowth of bone in the affected limb, which clearly indicates that the condition dates from before the closure of the primary epiphyses. In the cases reported, examination of tissues removed by dissection revealed a cirsoid arrangement of dilated arteries communicating with dilated veins, which was confirmed clinically by arteriograms. SUMMERFELDT, Toronto, Canada.

HYPOCHRONIC ANEMIA, CONGENITAL HEART DISEASE AND PECULIAR FACIES. P. R. EVANS, Proc. Roy. Soc. Med. **30**:1189 (Aug.) 1937.

These conditions were reported in a boy aged 11 months. At birth a systolic murmur and a thrill were noticed. The child progressed slowly. The results of the physical examination and of the study of the blood and pictures of the child accompany the report. Roentgen examinations showed a small pituitary fossa and the heart enlarged to the left. WILLIAMSON, New Orleans.

VENOUS PRESSURE IN INFANCY UNDER PATHOLOGIC CONDITIONS. V. MIGLIORI, Arch. ital. di pediat. e puericoltura **5**:333 (Aug.) 1937.

Using the apparatus of Alestra and Ruffini (*Arch. di pat. e clin. med.* **10**:177, 1931), Migliori made determinations of venous pressure on 60 normal children ranging in age from 5 to 10 years. The average value for each annual age period in this range varied from 97 to 107 mm. of water. There was no correlation between age and venous pressure within this range. In general, the values obtained for children appear to be higher than those of venous pressure in adults.

DOOLEY, New York.

VENOUS PRESSURE IN INFANCY UNDER PATHOLOGIC CONDITIONS. V. MIGLIORI and V. PACE, Arch. ital. di pediat. e puericoltura **5**:348 (Aug.) 1937.

Using the technic described in a previous publication (*Arch. ital. di pediat. e puericoltura* **5**:333, 1937; abstracted in foregoing paragraph), Migliori and Pace determined the venous pressure in 104 children with a variety of diseases. The values obtained for the children with infectious diseases tended to remain within normal ranges. The notable clinical usefulness of such determinations seems to be in that they indicate incipient cardiac decompensation, as in this case the readings rise. The number of children with heart disease in this series was too small, however, to permit any conclusion.

DOOLEY, New York.

BLOOD COUNTS IN THE FIRST YEAR OF LIFE. P. ROCCATI, Arch. ital. di pediat. e puericoltura **5**:366 (Aug.) 1937.

This is a discussion of the normal counts of the various cellular elements of the blood during the first year of life as reported in the literature and augmented from the author's own experience. The values he has observed do not differ substantially from those generally reported in the literature on this subject.

DOOLEY, New York.

VENIPUNCTURE IN THE YOUNG CHILD. E. PELUFFO, Arch. de pediat. d. Uruguay **8**:487 (Aug.) 1937.

Peluffo describes in considerable detail the technic of taking blood from the jugular vein of the infant or older child. He recommends this procedure for the withdrawal of blood for various determinations and also for intravenous medication. He has used the procedure on patients of all ages from 25 days to 11 years. He records only 8 failures in very young infants.

SCHLUTZ, Chicago.

PAROXYSMAL TACHYCARDIA IN A CHILD. W. PIAGGIO GARZON, Arch. de pediat. d. Uruguay **8**:562 (Sept.) 1937.

In a child of 2 years this condition followed a preventive injection of 1,500 units of diphtheria antitoxin. No anaphylactic phenomena were observed. Cardiac failure developed suddenly, with marked cardiovascular asthenia. The pulse rate rose to 180 per minute, and chilliness, profuse sweating and oliguria developed. Some of the symptoms subsided, but the child remained weak and pale. There was a return of all severe symptoms every twenty or twenty-five days during eleven months. The attacks were generally ushered in by malaise, hyperexcitability, chilliness and profuse perspiration. The pulse was always rapid. There was no dyspnea. The paroxysm would subside suddenly and would be followed by a state of marked depression. During the attack the electrocardiogram showed auricular fibrillation.

When the child was 4 years of age, the attacks ceased, the heart becoming entirely normal, with normal function.

SCHLUTZ, Chicago.

Transfusion of Citrated Blood. A. Christ, Beitr. z. klin. Chir. **162**:268, 1935.

Christ gives the following résumé of indications and contraindications for transfusion of blood based on the results of 700 transfusions done since 1927 in the Surgical University Clinic of Basel, Switzerland.

Indications for transfusion

1. Loss of blood
2. Chronic infection
3. Cachexia
4. Toxemia

Contraindications

1. Circulatory disturbance
2. Unusual thrombosis
3. Severe arteriosclerosis
4. Anuria
5. Uremia

He highly recommends citrated blood for transfusion, stating that it serves as well as whole blood and permits a simplification of the technic.

Rubin, Boston.

Significance of the Occurrence and of the Absence of Hemosiderosis in Anemia of Infants and Small Children. B. Walthard, Jahrb. f. Kinderh. **146**:7 (Dec.) 1935.

Hemosiderosis is not a constant finding in the anemias of infants and small children. The appearance of hemosiderosis in childhood is conditional on a disturbance in the intermediary assimilation of iron.

Hemosiderosis of a high grade was found in cases of alimentary dystrophy, pylorospasm, congenital stenosis of the left main bronchus, Jaksch-Hayem anemia and goat's milk anemia.

Cow's milk anemia is looked on as an example of a high grade secondary anemia without hemosiderosis. The absence of hemosiderosis here is due to a deficiency of iron in the feeding rather than to a disturbance in the intermediary assimilation of iron.

The Herter type of infantilism is similar to cow's milk anemia in that typically hemosiderosis is not associated with the condition. In occasional cases it occurs. In these cases it is due to a disturbance in the intermediary assimilation of iron.

Landau, Hannibal, Mo.

Fatal Cerebral Hemorrhage in a Patient with Werlhof's Disease. H. J. Sporl, Jahrb. f. Kinderh. **146**:39 (Dec.) 1935.

The clinical and pathologic observations on a 10 year old child with Werlhof's disease are given. A fatal cerebral hemorrhage occurred during the fourth year of the disease. Permission for splenectomy was denied, but the usual other therapeutic measures were carried out.

Landau, Hannibal, Mo.

Inflammation of Cardiac Valves and the Sequelae in Childhood. P. von Kiss, Jahrb. f. Kinderh. **146**:77 (Jan.) 1936.

Descriptions of the classic clinical appearances of endocarditis verrucosa, or thromboendocarditis simplex, and endocarditis ulcerosa are given.

Endocarditis verrucosa (better known in this country as rheumatic carditis) in its various forms is described in detail pathologically and clinically and is contrasted with endocarditis ulcerosa.

Endocarditis simplex, or rheumatic endocarditis, is rarely the immediate cause of death except in the very young, its course for the most part being featured by recurrent attacks, with the patient becoming a cardiac cripple. Endocarditis maligna always ends in death. Its course may be rapidly fatal within a few days or may be prolonged for months.

LANDAU, Hannibal, Mo.

EXPERIMENTAL PRODUCTION OF NIEMANN-PICK DISEASE. H. BEUMER and G. B. GRUBER, Jahrb. f. Kinderh. **146**:125 (Feb.) 1936.

Following injections of sphingomyelin, a lipoid material found in Niemann-Pick disease, the characteristic cells of this disease were found in the spleens of the experimental dogs.

LANDAU, Hannibal, Mo.

INFLUENCE OF VITAMINS A, B, B_2, C AND D AND OF EGG YOLK ON THE THROMBOCYTE COUNT IN NORMAL INFANTS. E. SCHIFF and C. HIRSCHBERGER, Jahrb. f. Kinderh. **146**:181 (March) 1936.

Experiments showed that vitamin A, whether it was administered orally or parenterally, produced a distinct increase in the number of thrombocytes. Vitamin B_2 had the same effect, but this was less striking. Vitamins B and D had no influence on the number of platelets. With healthy children, neither oral nor intravenous administration of vitamin C in large doses resulted in an increase in the platelets.

The thrombocytosis continued only as long as vitamin A or vitamin B_2 was administered. The fall in thrombocytes occurring after the withdrawal of these vitamins was not in the least influenced by oral or intravenous administration of ascorbic acid.

LANDAU, Hannibal, Mo.

INFLUENCE OF VITAMINS A, B_2 AND C AND OF EGG YOLK ON THE THROMBOCYTE COUNT AND BLEEDING TIME. E. SCHIFF and C. HIRSCHBERGER, Jahrb. f. Kinderh. **146**:191 (March) 1936.

Two children suffering from Werlhof's disease were studied.

The addition of five egg yolks per day to the diet of each of these children was followed by a rapid increase in platelets.

Simultaneous administration of egg yolk and vitamin C resulted in a strikingly quick increase in platelets and rapid improvement in the bleeding time. The number of platelets also increased in both cases on the addition of vitamin A, and the bleeding time approached normal.

Simultaneous administration of vitamins A and C resulted in no striking change in the platelet count. In one child, however, an infection of the throat occurred during the experiment, and in the other the period of observation was short.

The results obtained with vitamin B_2 were not conclusive but suggested that the effect of this vitamin was nil.

On a general diet both children showed a diminution in platelets, followed by a spontaneous rise in about a week.

LANDAU, Hannibal, Ma.

COOLEY'S DISEASE. M. ORTOLANI, Monatschr. f. Kinderh. **71**:174 (Oct.) 1937.

In 1925 Cooley described an anemia characterized by persistent erythroblastosis, increase of bilirubin in the blood, enlargement of the spleen and liver and rarefaction of the entire skeleton. Ortolani now reports several cases and gives three roentgenograms of bones with characteristic findings. He submits photographs of these children, suggesting that they have an oriental appearance.

GERSTLEY, Chicago.

HEMATOLOGIC AND MORPHOLOGIC ASPECTS OF THE BONE MARROW IN INFECTIOUS MONONUCLEOSIS. N. G. NORDENSSON, Nord. med. tidskr. **14**:1297 (Aug. 7) 1937.

Nordensson reports 13 cases of infectious mononucleosis, 6 in children less than 13 years of age. Bone marrow obtained by puncture was found normal. Attention is called to the value of this method of investigation whenever it is doubtful whether acute lymphatic leukemia (metaplastic bone marrow) or infectious mononucleosis (normal bone marrow) is present.

WALLGREN, Göteborg, Sweden.

Diseases of Nose, Throat and Ear

THE SHAPE OF THE EAR IN RELATION TO BODY CONSTITUTION. H. VOLLMER, Arch. Pediat. **54**:574 (Oct.) 1937.

The human ear in its more highly differentiated form may give certain clues to the physical and mental characteristics of the individual. This phenomenon is comparable to the symbolism expressed in the ears in animals. In the different types of apes one can readily distinguish the more highly developed genus by the higher degree of differentiation of the external ear. The ears of human beings frequently display regressive features which are indicative of general degeneration. Peculiarities of lower species reappear. This is frequently noted in idiots, persons with congenital anomalies and patients with degenerative diseases. Several interesting photographs of the ears of a group of children suffering from various degenerative conditions are submitted.

ORR, Buffalo.

THE RESULTS OF RADICAL ANTRUM OPERATIONS IN CHILDREN. G. A. D. MCARTHUR, M. J. Australia **2**:470 (Sept. 18) 1937.

During the period from 1921 to 1931, inclusive, McArthur performed the radical Caldwell-Luc operation (entrance by way of the canine fossa), for removal of the mucosa, for the relief of chronic infection of the maxillary antrum in 40 children. Subsequent study of 20 of these children showed that the results had been good in 13, fair in 3 and bad in 4. Age is no contraindication to the operation, for an infant of 1 year and 9 months was among those relieved. As a rule, the teeth are not damaged by the operation. McArthur feels that the habit of doing only the intranasal operation in children is not justified.

GONCE, Madison, Wis.

OTITIS MEDIA IN EARLY CHILDHOOD (UNDER FIVE YEARS). J. M. LEMEE and others, Proc. Roy. Soc. Med. **30**:1293 (Aug.) 1937.

Dr. J. M. LeMee, W. T. Ritchie Rodger, Mr. Stirk Adams, Dr. C. S. Scott and Dr. R. B. Lunsden read long and fully considered articles on the aforesaid condition, viewing it from many standpoints. Dr. Gutherie, the president, opened the discussion. E. Watson Williams and McNair Scott also took part.

WILLIAMSON, New Orleans.

TREATMENT AT BOURBOULE OF CHILDREN WITH DILATATION OF THE BRONCHI. J. HALLE and P. FERREYROLLES, Bull. Soc. de pédiat. de Paris **35**:270 (May) 1937.

The results of the treatment of convalescent children with bronchiectasis sent from Paris to Bourboule are good. Most of these children did well after they returned home, according to replies received to a questionnaire sent to the parents. It is conceded that some of the children may have had thoracic infections without bronchiectasis, as the diagnosis of the latter was not definitely established in every case.

BENJAMIN, Montreal, Canada.

ACUTE LARYNGOTRACHEOBRONCHITIS IN CHILDREN. LE MÉE and A. BLOCH, Bull. Soc. de pédiat. de Paris **35**:277 (May) 1937.

Acute, fulminating laryngeal and tracheobronchial inflammation is serious because of the danger of suffocation by the thick secretion which adheres tenaciously to the mucous membrane and the possibility of spread of the infection to the bronchioles, producing bronchopneumonia. Direct laryngoscopic examination should be performed, as this is the only means of making a definite diagnosis. Bronchoscopic examination and aspiration through a rubber catheter are means which can be used to remove troublesome secretion. Intubation may be done, but tracheotomy is better, as it gives easy access for the removal of material from the trachea and bronchi.

BENJAMIN, Montreal, Canada.

DIRECT LARYNGOSCOPY IN THE THERAPY OF CROUP. LE MÉE, TRONCIN and A. SOULAS, Bull. Soc. de pédiat. de Paris **35**:310 (May) 1937.

A plea is made for direct laryngoscopic examination of all children with respiratory distress of the suffocative type. The procedure is described as simple enough to be done at the bedside in the home. It is particularly indicated in laryngeal diphtheria, laryngotracheitis and in the presence of small subglottic foreign bodies, such as splinters of wood, fish bones or food débris; also it is useful in applying the drop by drop method of instillation to outline the bronchial tree.

BENJAMIN, Montreal, Canada.

TEMPORAL ABSCESS OF OTITIC ORIGIN CURED BY PUNCTURE AND WIDE DECOMPRESSION. G. PAISSEAU and M. DAVID, Bull. Soc. de pédiat. de Paris **35**:321 (June) 1937.

A girl 8 years old began to show signs of an abscess of the right temporal lobe fifteen days after the beginning of acute suppurative otitis media on the right side without any infection of the mastoid. She was operated on seven weeks after the onset of the middle ear infection. The abscess was punctured, and about 20 cc. of pus was evacuated. A wide flap of bone was reflected, but the dura was not opened for decompression. Staphylococci and streptococci were present in the pus. The abscess did not have a definite capsule, and it is thought that most of the increase in intracranial pressure was due to the surrounding edema. When seen a year later, the child was well.

BENJAMIN, Montreal, Canada.

ANTRAL EMPYEMA IN INFANCY. E. GYÖRGY and R. VON MARTYN, Orvosi hetil. **81**:177 (Feb. 20) 1937.

György and Martyn have in numerous works presented the view that occult mastoiditis may cause alimentary disorders and maintain a toxic condition manifested as a parenteral infection. This can be stopped only by antrotomy. In the present article György and Martyn try to justify their opinion by the results of histologic examinations. In 10 cases they examined pieces of bone taken at antrotomy and in 8 cases the total os temporale taken at autopsy. In all cases pathologic changes were found.

GÖTTCHE, Budapest, Hungary.

TONSILLITIS AND TONSILLOSIS. I. SYK, Hygiea **99**:33 (Jan. 31) 1937.

Symptoms of illness localized to the tonsils are not always caused by a primary disease of the tonsils; the symptoms may be secondary to a morbid state of the nose, teeth, trachea, lungs or other regions, or they may be coordinate with diseases in these organs. In such cases there is no indication for tonsillectomy. The primarily diseased organs must be treated first, and if this treatment is successful the tonsillar symptoms disappear too. Syk calls conditions of the latter type

tonsillosis. In tonsillitis, on the other hand, the tonsils are diseased primarily, and in such cases a radical cure can be brought about by tonsillectomy.

WALLGREN, Göteborg, Sweden.

ULTIMATE RESULTS OF TONSILLECTOMIES. T. BETSHOLTZ, Hygiea **99**:319 (May 5) 1937.

In 1,405 patients the reason for tonsillectomy was recurrent tonsillitis in 59 per cent, repeated peritonsillitis in 12 per cent, nephritis in 2 per cent, disease of joints in 8 per cent and other indications in 19 per cent. One patient had an abscess of a lung following tonsillectomy. From one to six years later, it was found that 82 per cent of the patients with recurrent tonsillitis had been healthy and that 97 per cent of the patients with abscesses, 75 per cent of the nephritic patients and 51 per cent of those with disease of the joints had been free from their earlier symptoms.

WALLGREN, Göteborg, Sweden.

Diseases of Lungs, Pleura and Mediastinum

NONTUBERCULOUS PULMONARY LESIONS IN CHILDREN. C. W. NISSLER, Dis. of Chest **3**:10 (Oct.) 1937.

Nissler presents 3 cases of nontuberculous pulmonary lesions in which the tuberculin tests were positive and the roentgenograms showed involvement of an upper lobe, diagnosed tuberculosis. Atelectasis may resemble tuberculosis and may be due to the presence of a foreign body, new growth, granulating inflammations, the presence of an inspissated secretion, bronchitis, bronchopneumonia, whooping cough, congenital cyst of the lung or fibrosis of the lung due to chronic infection, perhaps with bronchiectasis. After a cutaneous test and a roentgen examination have been made, smears and cultures of sputum and of stomach washings should be examined repeatedly. If all are negative, bronchoscopic study may be indicated to obtain sputum and to determine the nature of the pathologic process.

HEERSMA, Kalamazoo, Mich.

TREATMENT OF PULMONARY ABSCESS WITH SHORT WAVES. S. FIANDACA, Brit. J. Phys. Med. **12**:25 (June) 1937.

It is concluded that treatment of pulmonary abscesses by short waves is efficacious in about 70 per cent of the cases. It is claimed that the "metapneumonic pulmonary abscesses" are most sensitive to the therapy and are cured after a relatively short period of treatment, while suppuration due to bronchiectasis is much more resistant. A successful cure of echinococcus cysts of the lungs is reported.

A wavelength of 15 meters is used, and the largest possible dose is given, short of burning. The technic is described.

HARTMAN, Cleveland.

VACCINOTHERAPY FOR BRONCHOPNEUMONIA. R. NATIVELLE, Bull. Soc. de pédiat. de Paris **34**:64 (Jan.) 1936.

The hypothesis is made that young forms of micro-organisms, taken when they are relatively invisible as compared with their mature adult visible forms, should yield vaccines which would have better antigenic value in the production of immune bodies when injected into man. It is difficult to obtain good growths of bacteria at this stage. Nonspecific vaccines of this type, containing streptococci, staphylococci, pneumococci and colon bacilli, were administered subcutaneously to 10 children with bronchopneumonia, some with this disease in the acute stage and some whose disease was in the protracted period of delayed resolution. The details are not mentioned. The results were considered favorable.

BENJAMIN, Montreal, Canada.

PULMONARY ABSCESS IN AN INFANT OF SEVEN MONTHS. J. BONABA and M. L. SALDUN DE RODRIQUEZ, Arch. de pediat. d. Uruguay **8**:517 (Aug.) 1937.

The infant had been in contact with an aunt affected with pulmonary tuberculosis. At birth he had been subjected to BCG vaccination. At the age of 3 months he began to have repeated attacks of bronchitis. The skin reaction to tuberculin was mildly positive. At the age of 7 months he showed a condensation of the lower part of the right lung. A dense shadow involving the entire right lung was seen in the roentgenogram. Extensive vomiting, which persisted for two days, produced largely purulent material. Preceding this, there had been symptoms of the presence of a pulmonary cavity. The Koch bacillus could not be demonstrated in the purulent material. Exploratory pulmonary punctures at no time yielded pus. Complete recovery finally resulted.

SCHLUTZ, Chicago.

ACUTE RESPIRATORY SYNDROME IN INFANTS, FOLLOWING ACCIDENTAL ASPIRATION OF OIL. T. VALLEDOR, Bol. Soc. cubana de pediat. **9**:293 (July) 1937.

Valledor presents 7 cases. All of the infants presented symptoms of suffocation and intense cyanosis immediately following aspiration of the oil. Five showed symptoms of pulmonary congestion with fever and roentgen findings for five days after the accident. Under adequate treatment all recovered rapidly, without showing any sequelae or abnormal roentgen findings.

When the condition occurs in a healthy infant or child with a normal laryngeal reflex, there is considerable asphyxia. This is not observed in the debilitated child or in one who is in coma. The oil may be aspirated into the trachea without causing any reaction.

In these cases a very chronic and generally fatal pulmonary disorder results.

SCHLUTZ, Chicago.

THE VOLUNTARY RESPIRATORY PAUSE IN CHILDHOOD. G. POTTHOFF and E. PUSCHEL, Jahrb. f. Kinderh. **146**:43 (Dec.) 1935.

Experiments were carried out on 174 children to determine the voluntary respiratory pause. The average was twenty seconds. This increased with advancing age. In children with inflammatory pulmonary changes and signs of cardiac decompensation with evidence of congestion or with pericarditis there was a decrease to from ten to six seconds. Further studies are to be carried out.

LANDAU, Hannibal, Mo.

FOLLOW-UP STUDY OF PATIENTS WITH SEROUS PLEURISY OBSERVED AT THE MEDICAL CLINICS IN STOCKHOLM. S. KARLSSON, Nord. med. tidskr. **14**:1123 (July 10) 1937.

The ultimate fate of 690 children and adults treated for serous pleurisy during the period 1915-1934 was studied. Fifteen per cent of the patients could not be found for reexamination; 33 others were reported dead from nontuberculous diseases, and the remaining 547 were examined by Karlsson. It was found that 75 per cent were healthy, 13 per cent were dead from tuberculosis, and 12 per cent were suffering from tuberculous diseases. In most cases the tuberculous disease developed within the first seven years after the pleurisy. Karlsson reckons with a tuberculous morbidity of 39 per cent and a tuberculous mortality of 22 per cent during the first two decades after pleurisy. Patients treated during the period of the World War (1915-1919) had a worse prognosis than those treated during other periods. Thoracocentesis has no influence on the prognosis. Poverty and heredity are of importance for the subsequent course of the tuberculous infection.

WALLGREN, Göteborg, Sweden.

Diseases of the Gastrointestinal Tract, Liver and Peritoneum

CHRONIC IDIOPATHIC ULCERATIVE COLITIS IN CHILDREN. R. M. SMITH, New England J. Med. **217**:541 (Sept. 30) 1937.

Blood in the stools is one of the most prominent symptoms of chronic idiopathic ulcerative colitis. Before this condition is diagnosed, however, one must consider first, and ultimately rule out, blood in the stools due to congenital anomalies, mechanical obstruction, localized lesions, systemic disease or an infection (bacillary dysentery, amebic dysentery, dysentery with fungous infection and tuberculous enteritis or colitis). Chronic idiopathic ulcerative colitis has not been proved to be of an infectious nature.

Smith has seen at the Children's Hospital, Boston, and in private practice 29 children with chronic idiopathic ulcerative colitis. Two of these children have not continued under observation. Of the remaining 27, 16 are alive. Seven of these have had only medical treatment; 2 of them still have the condition in an acute stage, and 5 are well. In none was the illness very severe. The duration of the disease in the cured patients varied from two to ten years. In 9 of the patients who are alive ileostomy was performed. In 5 of these the artificial opening was closed after a varying period of time, and these patients are well; 4 still have such an opening and are doing well. Eleven of the 29 patients are dead. Four died of perforation. One of these had severe lesions, reported in detail; in 2 the perforations occurred one week and ten days, respectively, after ileostomy and in the third the perforation followed colectomy. Two patients died of volvulus —two and three years, respectively, after ileostomy. One child died after ileostomy. One child died soon after ileostomy, of ileitis probably secondary to a general infection. One child died of severe tracheobronchitis two months after the artificial opening was closed. Another died of general peritonitis after an unsuccessful attempt to close the opening. One child died of carcinoma.

Two children aged 6 and 7 months, respectively, were operated on with apparently good results by Dr. William E. Ladd. In the 7 month old infant the symptoms began at the age of 3½ months.

GENGENBACH, Denver.

CONGENITAL PYLORIC STENOSIS IN SISTERS. D. E. JELKS, South. M. J. **30**:1027 (Oct.) 1937.

Congenital pyloric stenosis occurred in 2 sisters, the first and third of 5 children of the same mother. The other 3 children were free from diseases. Nowhere in the family history was there a record suggesting congenital pyloric stenosis. Both patients were submitted to the Rammstedt operation and made a complete recovery.

SCHLUTZ, Chicago.

A CASE OF RETROPERITONEAL CYST, WITH A CLINICAL STUDY OF THE SUBJECT. M. HAFEZI, Brit. J. Surg. **25**:267 (Oct.) 1937.

Retroperitoneal cyst is not as uncommon as once was thought. About 500 cases have been reported to date. The chief interest in its occurrence lies in the fact that it still presents somewhat of a problem in diagnosis. Hafezi reports a case of retroperitoneal cyst situated between the spleen and the stomach in the gastrolienal ligament.

Clinically this type of cyst may not be symptomless; i. e., it may take a chronic course and the complaint then is chiefly of a tumor but may be of pain, constipation and loss of weight; or there may be acute abdominal symptoms, chiefly obstructive in type. In all cases the most constant physical sign is a cystic tumor, which is usually freely mobile.

Differential diagnosis depends on the situation of the tumor. The vagueness of the symptoms and the failure to resemble those of the more common tumors of this region should arouse suspicion that a retroperitoneal cyst is present. Pain is

more often associated with a retroperitoneal cyst than with other abdominal cystic tumors.

The complications comprise perforation of the cyst, extreme emaciation of the patient, acute intestinal obsruction, hemorrhage into the cyst, torsion of the cyst and impaction into the pelvis, with obstruction of labor.

The treatment is surgical and, of the operative procedures, enucleation is the method of choice. This has a mortality of 9 per cent. Enucleation with resection has a mortality of 27 per cent. Marsupialization or simple drainage has a mortality of 16 per cent. Aspiration is condemned. SUMMERFELDT, Toronto, Canada.

COIN IN THE ESOPHAGUS FOR TWO YEARS. LE MÉE, J. POLACCO and A. SOULAS, Bull. Soc. de pédiat. de Paris **35**:293 (May) 1937.

A boy 4 years old was known to have swallowed a coin two years previously. He was taken to a physician immediately and repeatedly and subsequently to three other physicians during the two years, as he could not retain solid food. The surprising thing is that a roentgenologic examination was never suggested until the mother brought him to the dispensary. A roentgenogram showed a coin lodged in the esophagus. Esophagoscopic examination revealed marked esophagitis with dilatation of the esophagus, followed more distally by stenosis. No attempt was made to force the instrument farther in search of the coin. Another roentgenogram after a barium sulfate drink showed dilatation of the esophagus above a stricture and diverticula to the left and right below it. Gastrostomy was performed, and it was planned to attempt to dilate the stricture after the esophagitis subsided and remove the coin. BENJAMIN, Montreal, Canada.

PURULENT HEMORRHAGIC RECTOCOLITIS IN A CHILD, ASSOCIATED WITH AN ATYPICAL CELIAC SYNDROME (MALNUTRITION, OSSEOUS LESIONS, ABNORMAL BULKY STOOLS). WEILL-HALLE, A. LAMBLING and PAPAIOANNOU, Bull. Soc. de pédiat. de Paris **35**:368 (June) 1937.

A 12 year old boy had purulent hemorrhagic colitis at the age of 6½ years. Thereafter he continued to have frequent large stools. He had jaundice for a short time and polyarthritis, involving especially the knees twice. He showed infantilism, delayed ossification and atrophic transverse lines in the long bones. No dysentery bacilli or amebas were found in the stools. Although enlargement of the abdomen was absent, and the stools did not contain excessive amounts of fat, the condition was considered to be atypical celiac disease associated with chronic ulcerative colitis. The administration of hydrochloric acid, vitamins, glandular preparations and different diets failed to affect the course of the illness beneficially. BENJAMIN, Montreal, Canada.

THE OPAQUE ENEMA IN THE TREATMENT OF ACUTE INTESTINAL INTUSSUSCEPTION IN THE INFANT. G. BIANCHI, Riv. di clin. pediat. **35**:788 (Sept.) 1937.

The reduction of an intussusception in an infant by the giving of a barium sulfate enema, usually under some pressure, has led to successful cures of the condition in about 60 to 75 per cent of the cases reported in the recent literature. The colocolic, the cecocolic and the ileocecal types have been easily reduced, but it has been much more difficult to reduce an ileocolic and practically impossible to reduce an ileoileac intussusception by this means. These figures are better than those reported for surgical treatment of intussusception, with which the percentage of cures has been between 38 and 60.

Bianchi reports on 6 children under 1 year of age with intussusception who were treated by means of the barium sulfate enema under roentgen control. In 3 patients, ileocolic intussusception was successfully reduced and in 1 the condition was partially reduced; the latter patient was then treated surgically. Also, in 1 patient a cecocolic intussusception was successfully reduced. One infant with an intussus-

ception extending to 18 cm. from the anus and another with ileoileac intussusception were not relieved.

Bianchi believes that this procedure is harmless and useful and should always be undertaken before submitting a child to operative intervention.

HIGGINS, Boston.

NEWER TREATMENT OF THE SEVERE INTOXICATIONS OF INFANCY. J. P. GARRAHAN, Arch. argent. de pediat. **8**:839 (Sept.) 1937.

The first step is to inject intravenously a preparation made of equal parts of a 10 per cent solution of dextrose and Ringer's solution in the amount of from 20 to 30 cc. per kilogram of weight of the infant. Simultaneously 0.25 mg. of epinephrine is given subcutaneously every two hours and 1 cc. of a 25 per cent solution of pyridine betacarbonic acid diethylamide every six hours.

If there is much vomiting, all food is withheld for six hours, then a combination of lactate and Ringer's solution, with cooked starch and dextrose added, is given in the amount of from 150 to 200 cc. per kilogram. Small quantities must be given at first.

If nothing is retained by mouth, 200 cc. of Ringer's solution is given subcutaneously and from 15 to 20 cc. per kilogram of 10 per cent solution of dextrose intravenously, the latter solution by the drip method.

After this treatment, particularly if parenteral infections are present, Garrahan recommends blood transfusion, from 15 to 20 cc. per kilogram of the infant's weight. No transfusion should be given until twenty-four hours after the initiation of any other treatment.

Depending on the condition of the infant, these measures, except the blood transfusion, are repeated and may be continued for several days. The return to more substantial feeding must be extremely cautious. Garrahan prefers the use of modifications of protein milk or a buttermilk preparation.

SCHLUTZ, Chicago.

INGUINAL HERNIA ON THE LEFT SIDE WITH CECUM AND APPENDIX IN THE SAC. J. M. JORGE, F. MORCHIO and S. I. NUDELMAN, Arch. argent. de pediat. **8**:877 (Sept.) 1937.

The authors report this condition in a child 3 years old following a previous operation at the age of 1 year for bilateral inguinal hernia. At the later operation the ampulla of the ileum, the cecum and the appendix were found in the hernial sac on the left side. The contents could be easily reduced, and the hernial opening was successfully closed. Recovery was uneventful.

SCHLUTZ, Chicago.

CELIAC DISEASE. C. GIANELLI, Arch. de pediat. d. Uruguay **8**:496 (Aug.) 1937.

Gianelli describes the characteristic symptoms of this condition as exhibited in 4 typical cases.

In the treatment, the use of protein milk or buttermilk and fruit in the form of bananas proved most successful. This initial diet was later augmented by the addition of vegetables, more fruit and meat in the form of calf's liver.

SCHLUTZ, Chicago.

GASTROINTESTINAL AZOTEMIC SYNDROME IN INFANCY. A. VERGARA E., Rev. mex. de puericultura **7**:60 (Dec.) 1936; **7**:75 (Jan.) 1937.

This is a continuation of two articles in the two previous issues of this journal. The etiologic agents include bacterial toxins, food toxins and toxins from the disintegration of the body cells.

Vergara reports 6 cases and from his observations draws the following conclusions:

1. The terms "toxicosis," "alimentary intoxication" and "autointoxication" are vague terms to use in designating the acute gastrointestinal sufferings of early infancy because these terms do not represent definite conceptions of the symptomatic character of these nutritional upsets.

2. In any case of acute gastrointestinal infection with intense general metabolic disturbances, one must determine which metabolic disturbance predominates, and Vergara believes that his observations indicate that azotemia is of the first importance and that of second importance are anhydremia, acidosis and alkalosis.

3. Biochemical analysis of the blood is indispensable in the establishment of the metabolic dysfunction.

4. The acute azotemic gastrointestinal syndrome is established clinically, first by the manifestations of nervous origin with a picture very similar to that of uremic coma and, second, by the considerable elevation of the blood urea, which was encountered in all Vergara's observations, the minimum amount of urea being 51 mm. per hundred cubic centimeters of blood.

5. The suffering is gravest when the blood urea is most elevated, the syndrome improving with the establishment of diuresis and with the consequent diminution of the azotemia.

6. The metabolic disturbances of cholera infantum that produce a negative metabolism for all the principal foods influence mightily the production of azotemia, since there exists an increased combustion of organic protein, giving a considerable increase in blood nitrogen.

From these conclusions, Vergara is able to deduce that of all metabolic upsets the most important is represented by azotemic intoxication, because the syndromes of alkalosis and acidosis are not more than secondary to an upset in the acid-base equilibrium of the organism. This inequilibrium does not alone represent the gravity of the cholera syndrome, because it is common to observe intense upsets in the acid-base equilibrium of the blood in athreptic infants who do not present the cholera picture.

One is able to deduce too that in dietetic treatment one uses the albumin milk with added lactose; also dextrose, Ringer's solution and lactate-Ringer's solutions (as devised by Dr. Hartmann).

HERRON, Monroe, La.

RESULTS OF MANAGEMENT OF ACUTE APPENDICITIS AND ITS COMPLICATIONS IN THE SURGICAL UNIVERSITY CLINIC OF GÖTTINGEN BETWEEN 1912-1934. W. GREINER and others, Beitr. z. klin. Chir. **162**:426, 1935.

Greiner and his collaborators summarize the results in the following manner:

	Patients Admitted Forty-Eight Hours or Less After Onset		Patients Admitted Later Than Forty-Eight Hours After Onset		
Condition	Number Admitted	Number Who Died	Number Admitted	Number Who Died	Percentage of Total Number
Acute appendicitis	3,462	48 (1.4%)	786	75 (9.5%)	2.9
Diffuse peritonitis	161	35 (21.7%)	145	58 (40%)	30.4
Localized abscesses operated on	259	13 (5%)	306	16 (5.7%)	5.1
Exudative appendicitis, conservatively treated	103	1 (1%)	208	2 (1%)	1

They draw evident conclusions from the foregoing statistics.

RUBIN, Boston.

LATE CLINICAL AND ROENTGENOGRAPHIC EXAMINATION OF CHILDREN TREATED FOR PYLOROSPASM. A. VIETHEN, Jahrb. f. Kinderh. **146**:61 (Jan.) 1936.

Forty-six children who had suffered from pylorospasm earlier were studied clinically and roentgenographically. Of these, 37 had been treated conservatively and 9 surgically. The observations were made from two to ten years after treatment.

With 26 children, two types of variation from the normal were established; (*a*) In 18 whose pylorospasm had been handled conservatively, atonic stomach with prolonged emptying time and deficient peristalsis were found. (*b*) In 8 there were nervous disturbances with strong peristalsis and accelerated emptying time. Twenty children revealed no deviations from the normal.

Observations on 56 normal children as controls disclosed that frequently healthy children have quite large stomachs.

Roentgenographically demonstrable functional disturbances appear not only in the conservatively but also in the surgically treated children. A real difference between the two groups in favor of the group operated on was not established.

LANDAU, Hannibal, Mo.

A CASE OF CHRONIC INTUSSUSCEPTION. G. GRÖNBERGER, Svenska läk.-tidning. **34**:524 (April 9) 1937.

A boy of 3 years, previously healthy, was first seen in November 1935. He had had attacks of pain in the left side of his abdomen, sometimes combined with vomiting. The bowels were normal. At examination, a fortnight after the beginning of the symptoms, there were no findings except a temporary tumor-like tumefaction below the left border of the ribs and blood in the stools. A roentgen examination, with a colonic enema, showed the typical signs of a colonic intussusception, which began at the cecum and ended at the lienal flexure. The invaginated part of the intestine was slightly permeable. Disinvagination without resection was performed. The boy was discharged healthy.

WALLGREN, Göteborg, Sweden.

SUCCESSFUL OPERATION FOR CONGENITAL INTESTINAL STENOSIS. G. GRÖNBERGER, Svenska läk.-tidning. **34**:585 (April 23) 1937.

A breast-fed infant, a boy, whose weight at birth was 3,600 Gm., was first seen on Oct. 12, 1935, at the age of 4 months. One week previously he had begun to vomit after meals. His symptoms had increased in severity, and at last the vomitus became bile stained and the stools dark. There was loss of weight. The health was impaired. Convulsions developed, with distention of the stomach. The peristaltic waves were visible. Roentgen examination showed stenosis in the upper part of the jejunum, with great dilatation of the upper part. At operation the stenosis in its proximal part was similar to pyloric stenosis. A simple plastic operation was performed on the lumen. The infant was discharged healthy on Nov. 19, 1935.

WALLGREN, Göteborg, Sweden.

CONGENITAL PYLORIC STENOSIS WITHOUT CLINICAL SYMPTOMS. A. WALLGREN, Svenska läk.-tidning. **34**:635 (April 30) 1937.

Biovular twins were first seen when they were 1 month old. The boy had clinically and roentgenologically typical congenital pyloric stenosis. He was treated internally and discharged, free from symptoms, at the age of 2½ months. The girl did not vomit. Her weight increased in a normal way. Peristaltic waves were never visible, and no pyloric tumor was palpable. The roentgenologic examination displayed, however, the changes of the pyloric part of the stomach pathognomonic for congenital pyloric stenosis.

WALLGREN, Göteborg, Sweden.

A DIAPHRAGMATIC HERNIA. S. HOLM, Ugesk. f. læger **99**:782 (July 22) 1937.

A girl, first seen at the age of 8 months, had suffered from periodic vomiting since she was 3 months old; the vomitus was sometimes sanguinolent. A splashing sound was heard over the right side of the chest. On the front the percussion note was tympanitic. Diaphragmatic hernia was diagnosed and verified roentgenologically. A conservative plan of treatment was followed.

WALLGREN, Göteborg, Sweden.

Nervous Diseases

TRANSMISSION OF NERVOUS EFFECTS BY ACETYLCHOLINE. H. DALE, Bull. New York Acad. Med. **13**:379 (July) 1937.

This article contains a discussion of the chemistry of nerve transmission, based on experimental work in physiology.

JAHR, Omaha.

TUMOURS OF THE SYMPATHETIC NERVOUS SYSTEM IN CHILDREN: A STUDY OF TWENTY-FIVE CASES. R. O. STERN and G. H. NEWNS, Arch. Dis. Childhood **12**:267 (Aug.) 1937.

In 24 of these cases the tumor of the sympathetic nerves was in the abdomen and in the twenty-fifth in the chest. Two thirds of the cases occurred in males and one third in females. The average age of the group with the Hutchinson syndrome was 3½ years; that of the group with the Pepper syndrome, 2½ years, and that of the children with bony and visceral metastases, 2 years and 8 months. The average age of the patients with the Hutchinson syndrome was lower, and that of patients with the Pepper syndrome higher, than that of other series described in the literature. In many cases the tumors formed large retroperitoneal masses. In a small proportion of these the adrenals were normal, and the tumor must have arisen from the abdominal sympathetic chain. The tumors arose from either side with equal frequency. There was no relation between the side of origin and the situation of the metastases. Metastases were found in the kidneys, lung, pancreas, intestine, ovary and brain, as well as in the liver and bones. The commonest early symptoms were pain in the lower limbs with limping and abdominal swelling. Periodic fever was common. Hypochromic anemia, partly due to large hemorrhages into the tumors, was present in half the cases. The presence of metastases in bones distinguishes tumors of this type from the Wilms embryoma, the other common malignant growth of early childhood. The histologic structure of the tumors is described and a simplified classification proposed. The name "sympathoblastoma" is suggested as a general term for this class of tumors.

KELLY, Milwaukee.

BISMUTHAL BIOTROPISM. R. MASSIERE, Gaz. d. hôp. **110**:957 (July 28) 1937.

A patient died of Landry's paralysis following the eighth injection of a bismuth preparation. Prior to treatment the patient showed some wasting and weakness of the scapular muscles and of muscles of the legs—a condition which was interpreted at first as a residue of poliomyelitis, as no sensory change or other sign of tabes was found. The author feels that the bismuth increased the vitality of the spirochetes already present in the central nervous system (electrostatic effect?).

KAJDI, Baltimore.

CURE OF A CASE OF ST. VITUS DANCE. R. WAHL, Med. Klin. **33**:901 (July 2) 1937.

A girl 11½ years old had had chorea intermittently since the age of 6 years. Her hearing and vision were impaired, and she had strabismus. Eradication of

advanced paranasal sinus disease led to disappearance of the chorea, and hearing and vision became normal. Proper postoperative care is important in avoiding recurrence.

SIEMSEN, Chicago.

LATENT MONGOLISM. W. MALZ, Monatschr. f. Kinderh. **70**:376 (July) 1937.

Malz reports on 30 children with epicanthus. Some of these were true mongolian idiots. Others were normal but showed stigmas of mongolian idiocy, such as an abnormal fifth finger or muscular hypotonicity. The author wonders if there may be a condition of latent mongolism.

GERSTLEY, Chicago.

MONGOLISM. S. LAHDENSUU, Monatschr. f. Kinderh. **71**:14 (Aug.) 1937.

Lahdensuu reports on mongolism as observed by him in a set of twins and in 2 children of another family. He reviews 260 cases of mongolism and concludes that it is definitely hereditary and degenerative, uninfluenced by extraneous factors.

GERSTLEY, Chicago.

PROTEIN FRACTIONS OF NORMAL AND PATHOLOGIC SPINAL FLUID IN CHILDREN. P. UJSAGHY, Monatschr. f. Kinderh. **71**:37 (Aug.) 1937.

In this and the following article, numbered 3 and 4 of a series (which I am here summarizing together), Ujsaghy concludes his studies on changes in the protein content of cerebrospinal fluid in disease. He has studied 25 cases of tuberculous and purulent meningitis, encephalitis and poliomyelitis. In all, 118 specimens were studied. Chemical determinations were made of total protein, albumin, total globulin, pseudoglobulin, euglobulin and fibrinogen.

Total protein runs closely parallel to the clinical course of the disease as well as do its fractions. Albumin increases somewhat more rapidly than does globulin. Fibrinogen and euglobulin increase from the beginning and reach high concentrations. During recovery globulin and fibrinogen drop sharply, followed by total protein and albumin. Often these changes precede clinical improvement.

Ujsaghy noted the changes in the protein values of spinal fluid in many of the infectious diseases, as diphtheria, scarlet fever and measles.

Of all the determinations, he is inclined to think that the determination of fibrinogen is of greatest importance. It seems to be a more constant index of the severity of the condition. In the exanthems, total protein may be increased without the child's showing toxic symptoms. However, in the severer toxic conditions increases in fibrinogen and euglobulin are found constantly.

GERSTLEY, Chicago.

PATHOGENESIS OF DIFFUSE GLIOMA OF THE THALAMUS, AQUEDUCT AND PINEAL REGION. E. BAASCH, Schweiz. Arch. f. Neurol. u. Psychiat. **39**:26, 1937.

Baasch reports the case of a youth aged 17 who had suffered for thirty months from headache, vomiting and gradual loss of vision. Examinaion disclosed infantile habitus, secondary atrophy of the optic nerve and separation of the cranial sutures. Two hours before death the patient had a generalized convulsion, which was followed by persistent myoclonic twitching of the right eyelid and the right corner of the mouth. The brain showed marked internal hydrocephalus, which was due to occlusion of the aqueduct by a tumor nodule extending from the posterior part of the right thalamus and by neoplastic infiltration of the surrounding tissues. The entire dorsal half of the right thalamus was invaded by the tumor, which had crossed the median line in the posterior and habenular commissures, as well as in the region of the massa intermedia, to invade the posterior portion of the left thalamus.

Ependyma-lined cysts were observed in the right thalamus, near the attachment of the tumor nodule. The nodule itself contained spindle-shaped unipolar and

bipolar cells, with triangular cells, some of which were multinucleated, lying between them. In another type of tissue within the tumor the cellular processes were fibrillary and formed a thick network. A third kind of tissue was discovered in a sharply circumscribed area of the right thalamus. The tumor cells were large, rich in protoplasm, multinucleated in part and attached to blood vesels by one or more thick protoplasmic processes. There were also many fibrillary processes. At the margins of this area, a fourth type of tissue was encountered. The vascular attachments here were much more slender, and the fibrillary processes were finer in texture than in the preceding type. At some distance from the ventricular walls these various kinds of tissue changed gradually into a fifth type, made up largely of small atypical cells, some of which contained pigment, with a few bipolar and multipolar elements. This portion, designated by Baasch as the "dispersion zone," made up the bulk of the tumor. Anomalies of the ependyma were encountered in various parts of the third ventricle and aqueduct.

Baasch classifies the third type of tissue as astroblastoma, with transition into fibrillary astrocytoma, and the fourth type as astrocytoma predominantly fibrillary in character, with plump and giant astrocytes. The second type of tissue is regarded as fibrillary astrocytoma, characterized by elongated astrocytes with a few spongioblastic elements. The first type of tissue, though containing many spongioblasts, did not have the cellular arrangement characteristic of polar spongioblastoma, nor, since the cells did not have vascular attachments, could it be called astroblastoma. The fifth type of tissue, making up the bulk of the tumor, was similar to the diffuse gliomas of the pons and mesencephalon. Baasch believes that the tumor developed from a persisting layer of undifferentiated subependymal cells. The various anomalies of the ependyma, the character of the cells in the subependymal germinal layer and the fact that these cells are not normally present in a person of 17 all support this opinion.

DANIELS, Denver. [ARCH. NEUROL. & PSYCHIAT.]

MENINGITIS IN ACUTE NONSPECIFIC INFECTIONS. A. GJERTZ, Nord. med. tidskr. **14**:1112 (July 10) 1937.

Gjertz reports 14 cases of acute meningitis of benign type with very slight clinical neurologic symptoms in patients suffering from nonspecific catarrhal infections of the upper part of the respiratory tract. The spinal fluid was found sterile and contained from 50 to 400 cells, principally mononuclears. Twelve of the cases occurred in the period from July to December, which gives the author reason to suspect that there may have been a poliomyelitic origin of the disease, at least in some cases.

WALLGREN, Göteborg, Sweden.

MENINGOENCEPHALITIS OF UNKNOWN ORIGIN. R. BERGMAN, Nord. med. tidskr. **14**:1114 (July 10) 1937.

Bergman has found that there is a positive correlation between the frequency of typical poliomyelitis and that of benign lymphocytic meningitis and that these diseases show the same seasonal distribution. He therefore believes that in at least some cases meningitis is of poliomyelitic origin.

WALLGREN, Göteborg, Sweden.

CROSSED THALAMOCEREBELLAR ATROPHY. V. W. D. SCHENK, Psychiat. en neurol. bl. **41**:218, 1937.

Schenk describes the brain of a man aged 61 who became epileptic and mentally abnormal after a fall at 2 years of age. The only neurologic sign was a questionable Babinski reflex on the right. Histologically, the left inferior olive was atrophied, orally and dorsally. The olivocerebellar fibers in the restiform body were absent, and the cortex of the right cerebellar hemisphere, except the flocculus, was atrophic. The right dentate nucleus, the right brachium conjunctivum and the left red nucleus, as well as the left rubrothalamic tract, were smaller than

the corresponding structures of the opposite side. The most severe atrophy was observed in the left anterior thalamic nucleus, the cells and fibers of which had completely disappeared. There was less atrophy in the lateral thalamic nucleus. The left medical nucleus of the mamillary body and the bundle of Vicq d'Azyr were also atrophic. Atrophy of from 20 to 30 per cent occurred in cortical areas 6aα and 6aβ and of from 10 to 20 per cent in areas 8, 9, 11, 25 and 33. Schenk assumes that the primary lesions was agenesis of immature, growing elements in the optic thalamus. The degenerations in the mamillary body and in the rubrocerebellar system caudal to the inferior olive were considered of retrograde nature. The mild degree of atrophy in the internal capsule was probably dependent on degeneration of the frontothalamic and the thalamofrontal fibers. In contrast to the usual cases of crossed cerebrocerebellar atrophy, crossed thalamocerebellar atrophy apparently is rare.

LEWY, Philadelphia. [ARCH. NEUROL. & PSYCHIAT.]

Diseases of the Genitourinary Tract

CONGENITAL POLYCYSTIC KIDNEY, WITH REPORT OF ITS OCCURRENCE IN SEVERAL MEMBERS OF ONE FAMILY. G. R. GORDON and A. TRASOFF, Am. J. M. Sc. **194**:112 (July) 1937.

Polycystic kidneys in 9 members of a family are reported. The family tree is given. Emphasis is placed on careful taking of the family history and pyelographic examination to aid diagnosis.

HENSKE, Omaha.

FAILURE OF SULFANILAMIDE (PARA-AMINOBENZENESULFONAMIDE) THERAPY IN URINARY TRACT INFECTIONS DUE TO GROUP D (LANCEFIELD) BETA HEMOLYTIC STREPTOCOCCI. E. A. BLISS and P. H. LONG, New England J. Med. **217**:18 (July 1) 1937.

In the course of the authors' observations on the treatment of infections in human beings due to the beta hemolytic streptococcus with sulfanilamide (para-aminobenzenesulfonamide), they have seen 4 patients suffering from suspected hemolytic streptococcus cystitis and pyelitis in whom intensive therapy with the chemical was of no avail. These patients were women, and in each instance the strains of streptococci isolated from the urine had the biochemical and cultural characteristics of beta hemolytic streptococci of group D.

It has been their experience that if a strain of hemolytic streptococci is susceptible to the bacteriostatic effect of sulfanilamide in vitro, one can count on this substance having a definite therapeutic effect in vivo.

The failure of the substance to exert a bacteriostatic effect on the beta hemolytic streptococci of group D and the minute members of group G in vitro is of both theoretic and practical importance.

The authors believe that before therapy is started in an infection of the urinary tract due to the hemolytic streptococcus the response of the isolated organism to sulfanilamide should be tested in vitro. If this chemical exerts a bacteriostatic effect, therapy with this agent is indicated; if it does not, treatment with sulfanilamide will probably be of no avail.

GENGENBACH, Denver.

PATENT URACHUS. W. P. HERBST, South. M. J. **30**:711 (July) 1937.

Herbst has used the following methods of treatment for this condition, with results are given: (1) extirpation of the urachus, usually with after-treatment as in excision of the vermiform appendix, with 47 recoveries, 1 death and 1 recurrence; (2) ligation or suture alone, with 9 recoveries, 1 failure and 2 recurrences, 1 of them in childhood; (3) removal of obstructions to normal flow of urine (phimosis, vesical stone or tumor, prostatic hypertrophy, urethral stricture), with 8 recoveries, 1 death and 1 failure; (4) cauterization, actual or chemical, of the

umbilical orifice, with or without ligature and suture, with 7 recoveries, 1 death, 1 failure and 1 recurrence in adulthood; (5) removal of stone and other sources of irritation from the urachus, with 4 recoveries; (6) simple compression, with 4 recoveries and 2 failures; (7) slitting and packing of the urachus, with 3 recoveries and 1 death, and (8) plastic closure of the urachus, with 1 death.

SCHLUTZ, Chicago.

DERMOID AND ALLIED CYSTS OF THE KIDNEY. J. C. ROSS, Brit. J. Surg. **25**:293 (Oct.) 1937.

To date there have been reported 8 cases of dermoid cyst of the kidney, including the case reported in this summarizing article. In addition, there have been reported 7 cases of what might be called paradermoid of the kidney. Nearly all the patients suffered from backache or renal colic of varying severity, and many complained of dysuria, frequency of micturition and hematuria. In none of these cases was a correct preoperative diagnosis made.

Dermoid cyst of the kidney is due to an epidermal rest derived from the wolffian duct and is supposed to contain no dermal glands. The origin of the paradermoid type of cyst has not been satisfactorily explained, but it is believed to be a result of hemorrhage into a solitary serous cyst.

SUMMERFELDT, Toronto, Canada.

SPECIMEN OF CONGENITAL GENITO-URINARY ABNORMALITIES WITH SUPRARENAL ENLARGEMENT. P. R. EVANS, Proc. Roy. Soc. Med. **30**:1190 (Aug.) 1937.

A baby aged 7 weeks was admitted to the hospital after it had had two convulsions and had been vomiting for a fortnight without ceasing. The vomiting was projectile. Dextrose-saline solution was given subcutaneously and the child warmed, but death occurred a few hours later.

The clitoris was 2 cm. in length and 1 cm. in diameter. The labia consisted of loose skin similar to infantile scrotal skin. No vaginal orifice was present. Postmortem examination (permission was given for incomplete examination only) showed a horseshoe kidney, large adrenals, a urethra with a well developed verumontanum and below this an opening into a vagina, with a normal uterus, tubes and ovaries. No testicles were found in the abdomen or in the inguinal canal. The report is accompanied with pictures of the genitalia.

WILLIAMSON, New Orleans.

UNUSUAL DEFORMITY OF THE GENITALIA. J. G. O'DONOGHUE, Proc. Roy. Soc. Med. **30**:1193 (Aug.) 1937.

This condition was observed in a boy aged 3½ years. The child suffered from nocturnal enuresis. Examination of the external genitalia revealed (1) that both testicles were present in the scrotal sac, (2) that the penis was represented by a loose fold of skin situated on the posterior portion of the perineal raphe and overhung the opening of the anal canal, and (3) that there was a small external urethral opening on this fold of the skin. In every other respect the child seemed normal.

WILLIAMSON, New Orleans.

A SUPERNUMERARY URETER OPENING INTO THE VAGINA IN A CHILD. BOPPE, CLÉMENT and MARCEL, Bull. Soc. de pédiat. de Paris **35**:267 (May) 1937.

A girl 3 years old was thought to have enuresis. She was admitted to the hospital where it was found that urine was coming from the vagina. She voided normally as well, and there was no incontinence. Intravenous pyelography revealed the presence of two pelves and ureters on the right side, the supernumerary tube coming from the upper part of the kidney and running downward posterior to the normal one. It was dilated and tortuous. Cystoscopy was performed; the left ureter was easily catheterized, but the right could be entered for only a short

distance. The bladder was normal. Direct examination of the vagina showed an opening in the posterior part, from which urine trickled. At operation the upper part of the kidney and the supernumerary ureter were resected, and the remaining half of the kidney was fixed at a higher level to prevent kinking of the normal ureter.

BENJAMIN, Montreal, Canada.

MANDELIC ACID AND ITS DERIVATIVES IN THE TREATMENT OF URINARY INFECTIONS. H. DUVERGEY, Gaz. d. hôp. **110**:797 (June 19) 1937.

Duvergey reviews the English publications on this subject. He emphasizes Helmholz's observation that the effective concentration of mandelic acid varies with the urinary p_H. He warns against its use in patients with tuberculosis of the kidney or with the level of the nonprotein nitrogen elevated.

KAJDI, Baltimore.

UROLOGIC STUDY OF CHRONIC PYURIA. M. SCHEPELER, Arch. d. hosp. de niños **7**:77 (June) 1937.

For successful treatment of this condition, frequent examination of urine obtained by catheterization is required. The specimens must be taken under aseptic precautions.

Marked dystrophy often favors the development of chronic pyuria, but it may be equally true that chronic pyuria directly causes dystrophy. The colon bacillus is the most frequent cause of the disorder. The disease often follows intestinal infections.

Any patient whose pyuria does not clear up after a month of medical treatment should have a complete urologic inventory. The only contraindications to cystoscopic examination and ureteral catheterization are anatomic, related to the age of the subject. In the majority of the patients with chronic pyuria congenital anomalies are present. Repeated drainage of the renal pelvis with subsequent instillation of antiseptic substances often gives good results in the treatment.

SCHLUTZ, Chicago.

TREATMENT OF TESTICULAR ECTOPIA WITH GLANDULAR PREPARATIONS. R. RUCETA DE BUNO, Arch. de pediat. d. Uruguay **8**:555 (Sept.) 1937.

The author advocates treatment of testicular ectopia with glandular extracts whether the condition occurs alone or with adiposity of genital origin. Since insufficiency of thyroid function is often associated with cryptorchidism, it is well to give desiccated thyroid along with the gonadotropic substance. This combined treatment should always be tried before surgical intervention and before the age of puberty.

The beneficial results are most apparent in the external genital apparatus. Both the penis and the testicles enlarge.

The 6 patients in whom favorable results were observed ranged in age from 5 months to 10 years.

SCHLUTZ, Chicago.

FERMENTATION BY LACTIC ACID IN THE TREATMENT OF LIPOID NEPHROSIS. M. GESTEIRA, Pediat. e puericultura **6**:31 (March) 1937.

An artificial lactic acid milk, lactozym, was used. It was not very successful in the 2 cases in which it was used. Bacteriophage, however, seemed to cause improvement.

SANFORD, Chicago.

TORSION OF THE TESTICLE. C. A. IZZO, Rev. chilena de pediat. **8**:393 (July) 1937.

Izzo reports 4 cases of torsion of the testicle, 2 in infants and 2 in older children. One of the latter was a boy of 12 years. The condition occurs most frequently between the ages of 10 and 15 years and is rare in infants. Acute

orchitis is always present. Masturbation may be a contributing factor. Early operation will usually correct the torsion. If the condition has been present for some time, castration may be the safest procedure. SCHLUTZ, Chicago.

THE PYELOLYMPHATIC REFLEX. K. HECKMANN, Röntgenpraxis **9**:441 (July) 1937.

Urologists are familiar with the fact that opaque substances injected during retrograde pyelography may extravasate into the substance of the kidney and may also be visualized outside of the kidney. This phenomenon may occur even though no pathologic process is demonstrable within the urinary apparatus and even though undue force has not been employed in the injection; it is conventionally ascribed to extravasation of the dye into the venules of the kidney and renal pelvis and is usually termed the pyelovenous reflux. Heckmann reports on two chance experiences which entitle him to assert that in some cases at least the reflux occurs through the renal lymphatic vessels. In both instances retrograde injection of the opaque medium produced clearcut visualization of a portion of the perirenal lymphatic plexus and of the neighboring lymph nodes. The roentgenograms which are reproduced support his assertion in a convincing manner. According to Heckmann, dye may escape from the renal pelvis by any one of the following routes: (1) via the tubules; (2) through the lymph channels; (3) by way of the veins; (4) by way of a rupture of the kidney or of the renal pelvis through trauma or disease. MCCUNE, New York.

A CASE OF RENAL RICKETS. J. BICHEL, Hospitalstid. **80**:678 (June 15) 1937.

A girl of 15 had had nephritis since her first year and deformities of the bones since her second year of life. There was general hypotrophy. There were marked deformities of the lower extremities. Renal function was reduced. The nonprotein nitrogen content of the blood was between 150 and 170 mg. per hundred cubic centimeters; the blood calcium, 10.2 mg. Roentgenograms of the skeleton showed general decalcification but no changes typical of ordinary rickets. The teeth were normal. WALLGREN, Göteborg, Sweden.

PRIMARY FOCUS OF TUBERCULOSIS IN THE VULVA. A. NORDENSKJÖLD, Svenska läk.-tidning. **34**:638 (April 30) 1937.

A girl of 10 years fell ill with swellings of the inguinal lymphatic glands, fever and slight symptoms of vulvitis. Five days later erythema nodosum developed. At the examination, on the twelfth day, the tuberculin test was positive. There was a superficial ulcer in the neighborhood of the external orifice of the urethra (a primary focus) with periglandular edema. Tubercle bacilli were demonstrated in smears from the ulceration and in the extirpated gland. In the latter, typical tuberculous tissue was shown. Regression of the symptoms occurred, and the child was free from fever after a week. The primary focus healed with roentgen treatment. The lymphatic glands decreased in size and eventually were no longer palpable. No tuberculous changes were noted elsewhere in the body. The source and mode of the infection are unknown. WALLGREN, Göteborg, Sweden.

Diseases of the Ductless Glands; Endocrinology

PLASMA LIPIDS IN THE DIAGNOSIS OF MILD HYPOTHYROIDISM. E. M. BOYD and W. F. CONNELL, Quart. J. Med. **6**:467 (Oct.) 1937.

Boyd and Connell determined the blood lipids in 35 patients showing clinical signs of mild hypothyroidism. In 19 in whom no relief was obtained by the administration of thyroid the blood lipids were found to be normal, while in the remaining 16, in whom there was a response to thyroid, the blood lipids were significantly above normal.

The presence of mild hypothyroidism in these patients could not be predicted on the basis of the basal metabolism rate. The authors suggest that estimation of plasma lipids is a convenient way of differentiating cases of mild hypothyroidism. The ages of the patients are not stated.

BRADFORD, Rochester, N. Y.

EARLY MYXEDEMA IN INFANTS AND CONGENITAL SYPHILIS. E. LESNÉ and C. LAUNAY, Bull. Soc. de pédiat. de Paris **35**:126 (Feb.) 1937.

Myxedema was observed in 6 infants. Two died when they were between 3 and 4 months old. Necropsy revealed absence of thyroid tissue in 1 and some inflammatory reaction about the arterioles and capillaries as well as inflammatory glandular areas in the other. Of the 4 who were first recognized at the age of 3 months and survived, 3 were followed from seven to eight years, and a fourth was at the time of writing 2 years old. Of the 6 infants, 3 had congenital syphilis, which probably had no etiologic relation to their myxedema.

BENJAMIN, Montreal, Canada.

NEURATH-CUSHING SYNDROME. DUMOLARD and SARROUY, Bull. Soc. de pédiat. de Paris **35**:362 (June) 1937.

A boy 12 years old who presented a typical picture of adiposogenital dystrophy was treated by injections of a gonadotropic substance and later with injections of anterior pituitary extract. No improvement occurred; in fact, he grew taller and fatter during and after each course of injections.

BENJAMIN, Montreal, Canada.

EFFECT OF INJECTIONS OF ANTERIOR HYPOPHYSIAL PREPARATION ON GENERAL GROWTH AND DEVELOPMENT OF NEWLY BORN RABBITS. Y. MATSUURA, J. Orient. Med. **26**:1143 (June) 1937.

Matsuura injected daily 0.5, 1 and 2 cc. of a preparation of the anterior lobe of the pituitary gland (corresponding to 0.05, 0.1 and 0.2 Gm. of fresh glandular substance) into 50 newly born rabbits, divided into ten groups, each group composed of 5 healthy litter mates. The injections were given subcutaneously, beginning on the third day and continuing for a period of twenty-one days. Analyses of the data showed that the injections were not only ineffective but in some instances actually harmful, promoting premature death of animals. The histologic study of organs from the treated animals showed variable degrees of atrophy of the thymus gland but no other remarkable organic changes.

KATO, Chicago.

TREATMENT OF ADIPOSOGENITAL DYSTROPHY WITH A GONADOTROPIC SUBSTANCE. P. PLUM, Ugesk. f. læger **99**:643 (June 17) 1937.

Five children were treated. The effect was seen in an increased growth of the external genital organs after from six to eight weeks. There was no reduction of the body weight and no change in the basal metabolic rate. In a case of cryptorchidism without adiposity there was no descent after two months' treatment. In a case of cryptorchidism complicated with obesity and decreased basal metabolism, a descent took place in two weeks.

WALLGREN, Göteborg, Sweden.

EXPERIMENTAL AND CLINICAL EXAMINATION OF THE ACTIVITY OF PROTAMIN ZINC INSULIN. L. A. HULST and E. H. VOGELENZANG, Nederl. tijdschr. v. geneesk. **81**:3425 (July 17) 1937.

Protamin zinc insulin, in the authors' experience on 13 patients, has a different action from that of insulin and protamin insulin. In their opinion, the zinc is the main cause of this alteration in action, the outstanding feature of which is the delay of effect. Besides, it became clear to them why the final result can be

judged only after protamin zinc insulin has been administered for several days. It is easily understood why in some patients, as recorded in the literature, the action is unstable; the protamin zinc insulin treatment makes necessary a regulating action of the diabetic organism lest unfavorable results should ensue by summation of actions. This implies limitations in the application of this insulin; for each patent it should be tested carefully.

VAN CREVELD, Amsterdam, Netherlands.

Diseases of the Muscles, Bones, Joints and Lymph Glands

PROGRESSIVE MUSCULAR DYSTROPHY. L. BERMAN, New York State J. Med. **37**:1191 (July 1) 1937.

In progressive muscular dystrophy the following metabolic changes are found: hypoglycemia, an increase in blood sugar tolerance, hypocholesteremia and creatinuria with disturbance of creatine tolerance. Since hypoglycemia, hypocholesteremia and muscular asthenia are also found in Addison's disease and improve under the influence of adrenocortical extract, the same treatment was used in 22 patients with progressive dystrophy. At the same time parathyroid extract was given. Of the 22 patients, 6 were children. There was marked clinical improvement in 15 of the patients, accompanied by a rise in blood sugar and blood cholesterol. Standardized extracts were given for several months. Best results were obtained when the treatment was begun early, and little was to be expected if marked atrophy had occurred. Complete case reports are not given.

AIKMAN, Rochester, N. Y.

EARLY TREATMENT OF ACUTE STAPHYLOCOCCAL OSTEOMYELITIS. S. W. WILLIAMS, M. J. Australia **2**:459 (Sept. 18) 1937.

Williams compares the clinical results of surgical intervention, plus administration of antitoxin, in a series of 24 children suffering from staphylococcic osteomyelitis with the results in 42 control patients suffering from the same disease who were treated without antitoxin and finds the serum to be of no value. He regards surgical treatment by the modified Winnett-Orr method to be the best treatment for this disease.

GONCE, Madison, Wis.

RESECTION OF THE DIAPHYSIS OF THE TIBIA FOR ACUTE OSTEOMYELITIS, WITH ABNORMALLY RAPID REPAIR OF THE BONE. E. SORREL, LONGUET and GUICHARD, Bull. Soc. de pédiat. de Paris **35**:338 (June) 1937.

A boy 6 years old had acute osteomyelitis of the tibia. At operation a subperiosteal abscess was found. The shaft of the bone was resected, and the periosteum was closed with sutures. Three weeks later a roentgenogram showed some bone repair and another roentgenogram, taken four months and ten days after the operation, showed almost complete restitution of the bone.

About 30 cases of resection of the shaft of a long bone for osteomyelitis have been reported. In a few cases grafts were required later owing to the pseudarthrosis which had developed. The results obtained by this treatment are thought to be much better than those obtained by trephining the bone, which is usually followed by chronic osteomyelitis. Many roentgenograms are reproduced to illustrate how rapidly and completely the resected shaft is replaced by a new growth of bone.

BENJAMIN, Montreal, Canada.

CHRONIC FEBRILE OSTEOARTHROPATHY IN A CHILD. P. DELTHIL, Bull. Soc. de pédiat. de Paris **35**:402 (June) 1937.

A 9 year old girl had begun to have symptoms after a grippal infection at the age of 2 years. She had general limitation of all the joints and atrophy of

the extremities. She walked poorly and fell frequently. She had slight fever. There was no swelling or deformity of the joints; the teeth were normal; the liver and spleen were not enlarged, and there was no adenopathy. Roentgenologic examination showed generalized osseous decalcification and thinning of the long bones. In the shafts the medulla was less dense than is normal; in the epiphyses the intertrabecular spaces were widened, and the articular surfaces were poorly defined. There was no bony proliferation and no evidence of exostoses. The flat bones were of diminished density and their borders hazy. Sternal puncture yielded normal bone marrow. No blood culture was made.

BENJAMIN, Montreal, Canada.

MUSCULAR ATROPHY OCCURRING SIMULTANEOUSLY IN SINGLE OVUM TWINS. A. THOMAS, PAISSEAU, E. SORREL and SORREL-DEJERINE, Rev. neurol. **67**: 567 (May) 1937.

Identical twins, girls, were born prematurely at 7 months. They seemed to develop normally until the age of 18 months. One walked with support, and the other could stand with support. They contracted measles, complicated by bronchopneumonia, following which they were unable to stand, and their legs showed a flexion deformity.

Examination revealed atrophy of the leg muscles with posterior contractures. The quadriceps and gluteal muscles were totally paralyzed. Their mentality seemed well developed (the authors do not state the age of the children, but from pictures and roentgenograms they were apparently 3 or 4 years old). The thenar and hypothenar muscles were uninvolved. There were foci of atrophy in other parts of the body—the abdominal and dorsal muscles, the supinators of the arms and the flexors of the neck. The deep reflexes were absent. The Babinski response was normal. The eyegrounds were normal. The anal reflexes were missing. The children were enuretic.

Roentgenograms of the wrists in 1935 showed differences. One twin had six bones on the right and five on the left, while the other showed six on the left and four on the right. In 1937, the wrists were identical and the body measurements were nearly identical.

In November 1936, one twin underwent a brief febrile upset, with vomiting and convulsions, and a period of recovery, lasting about twenty-four hours, during which she was semicomatose. Seven hours after the onset of this incident, the twin presented identical symptoms. The following day both were in a confused state but recovered slowly from this. Fifteen days after the first symptoms both showed simultaneously a papular eruption of the forehead, nose and cheeks.

The authors point out the apparently identical susceptibility of the skin and nervous systems of the twins. They classify the nervous disorder among the myopathies, ruling out amyotonia congenita and progressive muscular atrophy. The etiologic background must remain unknown. Although the serologic study gave negative results, arsenicals were administered, without recognizable results.

DAFFINEE, Boston.

NECESSITY FOR EARLY DIAGNOSIS OF CONGENITAL LUXATION AND SUBLUXATION OF THE HIP. E. MARCER, Lattante **8**:575 (Oct.) 1937.

The earlier the diagnosis, the better will be the functional and esthetic results. Marcer reviews the recent contributions of the Italian orthopedic surgeon, Vittorio Putti, to the early diagnosis and treatment of this condition.

HIGGINS, Boston.

A Case of Relaxation of the Diaphragm. L. Cid Rojas, Arch. d. hosp. de niños **7**:71 (June) 1937.

Cid observed this rather rare condition in a child aged 3, in whom the condition had existed for eighteen months, following an attack of measles. The outstanding symptoms were chronic cough, frequent attacks of dyspnea and cyanosis. The chief causes operative in the development of this disorder are loss of muscular tone with an excessive increase of intra-abdominal pressure, both of which originate in fetal life.

Schlutz, Chicago.

End-Results of Tuberculous Hip Disease. K. von Haefen, Beitr. z. klin. Chir. **162**:404, 1935.

Routine roentgenologic examination is of the utmost importance. The progress toward complete cure can be determined much better with complete roentgenologic interpretation.

Rubin, Boston.

Medical Treatment of Acute Osteomyelitis. S. Simko, Monatschr. f. Kinderh. **71**:34 (Aug.) 1937.

Simko reports a case of acute osteomyelitis. Instead of resorting to surgical measures he gave sulfanilamide internally, and there was rapid improvement after three days.

Gerstley, Chicago.

Myositis Ossificans Progressiva in a Child. P. Dudás, Orvosi hetil. **81**:647 (June 19) 1937.

Dudás observed a 6 year old girl with myositis ossificans progressiva for three years. She was the fourth child of her parents; 2 brothers were healthy; 1 sister died of tuberculous meningitis. The illness showed rapid development in these three years. The motions of the head were very limited; the mouth could be opened for a distance of only 1 cm. The masseters and the muscles of the neck showed extensive calcifications; the same process was to be found in the muscles of the chest and abdomen. The movement of the shoulder joints was limited. Among the muscles of the arms, the biceps showed the greatest alterations. To the time of writing the treatment (roentgen irradiation of the spinal column) had met with no success.

Göttche, Budapest, Hungary.

Deformities of the Skull in Childhood. M. Fog, Hospitalstid. **80**:1045 (Sept. 21) 1937.

Fog describes deformities of the skull in 3 children aged, respectively, 3, 3 and 7 years, depending in each instance on premature synostosis of the sutures. The symptoms were those of increased intracranial pressure and choked disk, and there were roentgenologic changes in these skulls. He discusses at some length the different types of deformities of the skull and concludes that the common and essential cause of all is faulty ossification of the bones at the base of the skull combined with premature synostosis of the coronary suture. There is no sharp limit between the different types of deformities. All of them may be accompanied by neurologic, roentgenologic and ophthalmologic signs and symptoms due to local or general intracranial hypertension.

Wallgren, Göteborg, Sweden.

A Case of Osteomalacia of the Os Naviculare (Preiser's Disease). A. Hellstadius, Nord. med. tidskr. **14**:1159 (July 17) 1937.

Hellstadius reports a case of osteomalacia of the navicular bone of the left hand in a boy of 8. This disease, first described by Preiser, is related to Kienböck's disease (os lunatum) and Köhler's disease I (os naviculare pedis). It is of rare occurrence and mainly affects adolescents. The author believes that

trauma plays an etiologic rôle, producing a nutritional disturbance. A certain degree of immobilization is recommended, to prevent spontaneous fracture of the involved bone.

WALLGREN, Göteborg, Sweden.

Skin Diseases; Allergy

SULFANILAMIDE DERMATITIS: QUESTION OF RELATION TO PHOTOSENSITIVITY. L. A. BRUNSTING, Proc. Staff Meet., Mayo Clin. **12**:614 (Sept. 29) 1937.

Certain concentrations of sulfanilamide in the skin of susceptible persons may contribute to a state of photosensitivity. For this reason, patients who are under treatment with this drug should be shielded from direct exposure to rays of the sun.

MILLER, South Bend, Ind.

ERYTHEMA MARGINATUM (RHEUMATICUM). C. B. PERRY, Arch. Dis. Childhood **12**:233 (Aug.) 1937.

Erythema marginatum is a specific manifestation of acute rheumatism. The eruption occurs on the abdomen, chest, back and limbs but seldom on the face. This eruption usually first appears at the onset of a rheumatic attack or of a relapse but may continue long after all other evidence of rheumatic activity has disappeared.

KELLY, Milwaukee.

TREATMENT OF AIR-BORNE ALLERGIC CONDITIONS. E. M. FRAENKEL, Brit. J. Phys. Med. **12**:78 (Aug.) 1937.

A filtration device is described. This device is produced by a German manufacturer of gas masks. It is applied either to a mask or a small cubicle. By limited exposure to the air-borne allergens "natural desensitization" is attempted. Successful results are claimed.

HARTMAN, Cleveland.

A CASE OF DERMATOMYOSITIS. E. H. M. STEPHEN, M. J. Australia **2**:569 (Oct. 2) 1937.

The author reports a case of dermatomyositis succeeding an attack of measles in a 9 year old boy.

GONCE, Madison, Wis.

THE PSYCHOLOGICAL FACTORS IN ASTHMA-PRURIGO. C. H. ROGERSON, Quart. J. Med. **6**:367 (Oct.) 1937.

Rogerson describes his findings in a group of 30 children ranging in age from 3 to 15 years in whom the asthma-prurigo personality was present. He confirmed the impression held by some that the intelligence quotient of this type of child is above normal—the average in his group being 108, which is fully 20 points higher than that of a control group of children not suffering from this condition. He points out that many of this group possessed special features of personality and had environmental difficulties which were closely related to their attacks of asthma or of itching of the skin.

In them such psychogenic factors as temper tantrums, fright, anxiety and anger often precipitated attacks. Frequently the child was "nervous," presented a problem of behavior and was the only child overprotected by the parents.

The study clearly presents the psychogenic side of the problem, but it seems to the reviewer that a more thorough discussion of the relationship of these factors to well known specific factors, such as inhalants, would be instructive.

BRADFORD, Rochester, N. Y.

ACRODYNIA IN CHILDREN. H. ESCHBACH, Bull. Soc. de pédiat. de Paris **35**:60 (Jan.) 1937.

Three cases of typical and 1 of abortive acrodynia are reported. It is believed that the condition is becoming more common. The course of the disease was shorter after the use of a daily dose of 0.2 Gm. of acetylcholine as well as the ultraviolet rays.

BENJAMIN, Montreal, Canada.

SCLERODERMA IN BANDS AND PLAQUES OF RAPID DEVELOPMENT; ADVISABILITY OF PARATHYROIDECTOMY. R. MARTIN, BONNEFOI and A. DELAUNAY, Bull. Soc. de pédiat. de Paris **35**:207 (April) 1937.

A girl 5 years old began to have vague pains in the legs eighteen months prior to examination. Three months thereafter red spots appeared on the abdomen and face, which had waxy centers and were itchy; later violet spots became visible about the ankles, and there were telangiectases giving a marble-like appearance to the skin. The child became restless, lost weight and was soon hidebound so that she could not move the joints of the lower extremities. There were bands of sclerodermatous skin on the abdomen and similar plaques on the flanks. The bones showed slight decalcification. The blood calcium amounted to 101 mg. per hundred cubic centimeters and the basal metabolic rate was minus 11. Interferometric examination indicated thymic and ovarian dysfunction. It was decided to try glandular therapy for a time and if no improvement followed this treatment to perform parathyroidectomy. Photographs of the child are reproduced.

BENJAMIN, Montreal, Canada.

HIGH FAT FEEDING IN ECZEMATOUS INFANTS. J. DAMIANOVICH and A. M. CORDIVIOLA, Arch. argent. de pediat. **8**:859 (Sept.) 1937.

The authors report a number of cases and conclude that except for a small percentage, milk with high fat content is not harmful to eczematous infants. They are even under the impression that many of these babies seemed definitely improved if not entirely cured under such feeding.

SCHLUTZ, Chicago.

HYPERSUSCEPTIBILITY IN CHILDREN WITH ECZEMA. E. ZITZKE, Klin. Wchnschr. **12**:1047 (July 8) 1933.

Of 31 eczematous children, aged from 6 months to 4 years, 12 gave a positive reaction to egg white, 3 to cow's milk and 1 to wheat flour. In 9 eczematous children, aged from 4 to 14 years, no reaction was obtained to egg white or to wheat flour and only one reaction to cow's milk. In 84 controls without eczema, no reactions were obtained to these substances. The Prausnitz-Küstner passive transfer test was obtained in 3. Examination of 16 serums for complement fixation antibodies disclosed none.

Zitzke considers that susceptibility to protein cannot be the specific cause of eczema, since the removal of the particular substance from the diet does not clear up the eczema. Dietary treatment must be combined with local treatment to effect a cure; either alone does not avail. A direct etiologic connection between the reactive substances and eczema has not been definitely demonstrated. It is more likely that the reaction is nonspecific and is only a symptom of a higher susceptibility in the eczematous child's skin.

SILVERMAN, Syracuse, N. Y.

A CASE OF TOTAL ALOPECIA. N. LANDORF, Svenska läk.-tidning. **34**:641 (April 30) 1937.

An imbecilic girl of 4 years (mongolism) began at the age of 2 years to loose the hair on her scalp and then the hair of the eyebrows. Within six months the girl was totally bald. The condition has since remained unchanged except for a brief period during which there was a temporary reappearance of the hair on the scalp.

WALLGREN, Göteborg, Sweden.

Teeth and Dentistry

DENTAL ANOMALIES OF THE CHINESE. S. OHSHIMA, J. Orient. Med. **26**:1009 (June) 1937.

The material consisted of 500 skulls preserved in the department of anatomy in the Manchurian Medical College and 750 plaster casts of the mouth cavity made from adult Chinese. In these 1,250 specimens the author observed: (*a*) supernumerary teeth in the upper jaw in 2.6 per cent, but none in the lower; (*b*) Carabelli's tubercles in the first and second upper molars in 2.1 per cent, Balk's paramolar protuberance in the second upper molar in 0.3 per cent and Terra's interstitial tubercles in 1.3 per cent; (*c*) absence of teeth (most frequently the upper lateral incisors) in 1.7 per cent; (*d*) the separation of the upper central incisors in 3.9 per cent and separation of the lower central incisors in 0.9 per cent; (*e*) outer deviation of teeth in the upper jaw in 3.5 per cent and outer deviation of teeth in the lower jaw in 4.1 per cent; (*f*) torsion of teeth in the upper jaw in 24.2 per cent and torsion of those in the lower in 12.6 per cent.

KATO, Chicago.

DENTAL CARIES AS A PROBLEM OF NUTRITION. C. SCHIØTZ, Hospitalstid. **80**:57 (Jan. 19) 1937.

The hygienic conditions in five Norwegian nurseries for healthy children have been studied. In these nurseries dental caries was rare as compared to the frequency with which it is found in classes of the same age in the general population. Schiøtz concludes that the toothbrush is of no great value as a means of prophylaxis against caries. There is no proof that sugar or candy are directly harmful to the teeth; if the children get an appropriate diet with sufficient amounts of vitamins and mineral salts, sugar is not harmful. Children in the general population often get a deficient diet during some seasons and, according to the author, these faulty diets are often recommended by physicians.

WALLGREN, Göteborg, Sweden.

AN UNUSUAL CASE OF JUVENILE PARADENTOSIS. E. LENSTRUP and O. BRINCH, Paradentium **9**:1, 1937.

A boy, first seen at 11 years of age, had in his earlier years suffered from suppurative otitis and lymphoma of the neck but had otherwise been healthy. His deciduous teeth loosened and fell out before his third year. The permanent teeth too loosened and became elongated during their evolution; a number of them were already lost. Severe gingivitis was present, with deep pockets around the remaining teeth, which were all loosened more or less. Otherwise no disease was demonstrable. The calcium and phosphorus content of the blood was normal. There was no hereditary predisposition to diseases of the teeth.

WALLGREN, Göteborg, Sweden.

Miscellaneous

THE PHARMACOLOGIC BASIS FOR SULFANILAMIDE THERAPY. A. DEM. WELCH, J. Pediat. **11**:159 (Aug.) 1937.

A brief summary of the development of sulfanilamide is presented: In 1913 Eisenberg observed that certain azo dyes possessed considerable bactericidal action in vitro. About the same time Hörlein incorporated the sulfonamide groupings in azo dyes and noted that the ability of these dyes to enter into intimate combination with wool proteins was greater than that of similar dyes free from sulfonamide. In 1935 Domagk observed the bactericidal effect of these sulfonamide azo dyes on mice infected with hemolytic streptococci. Of these dyes prontosil

(a name applied to various derivatives of para-aminobenzenesulfonamide [now known as sulfanilamide]) was found to be one of the most active. Tréfouël and his co-workers and Buttle and his associates found that para-aminobenzenesulfonamide is the pharmacologically effective portion of the prontosil molecule. Other workers consider sulfanilamide (para-aminobenzenesulfonamide) more efficacious than its more complicated predecessors. Fuller has isolated sulfanilamide from the urine of patients receiving prontosil. Certain compounds related to sulfanilamide but not containing the sulfonamide grouping have been investigated and found to be more active, but in some instances they have been found to be more toxic to mice and in others to give undesirable side action.

The infectious agents affected by sulfanilamide are beta hemolytic streptococci, meningococci, pneumococci, gonococci and probably other species of microorganisms, e. g., certain bacterial species not belonging to the cocci.

Among the hypotheses advanced as to the mechanism of the action of sulfanilamide two are noted: The drug acts by preventing the formation of capsules and by affecting the phagocytic activity of the polymorphonuclear leukocytes and monocytes. It is known that sulfanilamide acts directly on certain bacteria, inhibiting rapid multiplication and enabling the normal bodily defenses to cope adequately with the invading organism. The fact that prontosil-like dyes enter into intimate combination with wool proteins when the sulfonamide grouping is present suggests to the author the possibility that the sulfonamide grouping is involved in the combination between the drug and constituents of the bacterial cell essential for life or reproduction.

Marshall and his associates developed a simple method of determining the amount of sulfanilamide in body fluids, enabling them to study the absorption and excretion of the drug. The drug is excreted by the human being partly in the acetylated form, para-acetylaminobenzenesulfonamide, a compound almost inactive. Subcutaneous administration of sulfanilamide does not lead to higher concentration of the drug in the blood than when it is given by mouth. The absorption from the intestinal tract appears to be complete within from three to four hours. From two to three days are required to establish equilibrium between the amount of drug injected and the amount excreted after daily administration of a given amount of the drug in divided doses. From two to three days are also required to free the system from the drug. The drug has been found in the saliva, pancreatic juice, bile and cerebrospinal fluid. In the last it is present in a concentration only slightly lower than that in the blood within a few hours after administration by mouth.

The author emphasizes the fact that the drug is not harmless and that complications may result from its use. These are, notably, the formation of methemoglobin and, in the presence of sulfates, sulfhemoglobin and the development of acidosis and agranulocytosis.

RAUH, Cincinnati.

MOVABLE SUPPORT FOR USE IN THE ROENTGENOLOGIC EXAMINATION OF INFANTS. P. AIMÉ, Bull. Soc. de pédiat. de Paris **35**:107 (Feb.) 1937.

The apparatus consists of two pieces, on one of which the infant is fixed, and then both are placed on the second piece, so arranged that rotation in two planes is possible.

BENJAMIN, Montreal, Canada.

SUSCEPTIBILITY TO MORPHINE AS INFLUENCED BY AGE. O. GIRNDT and R. HUESGEN, Monatschr. f. Kinderh. **71**:153 (Oct.) 1937.

In experiments on 23 and 25 rabbits Girndt and Huesgen determined the effect of age on susceptibility to morphine. In rabbits, at any rate, age is not a factor, as the dosage of morphine affecting the respiratory center averaged in both groups from 0.25 mg. to 0.5 mg. per kilogram of body weight. The writers do not believe that the results can be made applicable to human infants. Death in these animals was not from paralysis of the respiratory center but from convulsions and could be prevented by ethyl carbamate (urethane).

GERSTLEY, Chicago.

Society Transactions

CHICAGO PEDIATRIC SOCIETY

C. A. ALDRICH, M.D., *President*

Regular Meeting, April 19, 1938

GEORGE F. MUNNS, M.D., *Secretary*

INTRADERMAL IMMUNIZATION AGAINST SCARLET FEVER. DR. C. A. EARLE.

Prior to 1924, St. Mary's Training School at Des Plaines, Ill., an orphanage containing 700 to 800 children, had frequent epidemics of scarlet fever. After the elaboration by the Dicks of the scarlet fever toxin in that year, skin test doses were given to 794 children with material prepared by Dr. Gladys Dick. The skin test dose at that time was the amount of toxin injected into the skin which would produce an area of redness 1 to 2 cm. in diameter. At first the reactions were highly unsatisfactory, and many of the children were made ill. It has now been definitely shown that the toxin not only determines the status of immunity but produces immunization if given in suitable doses properly spaced. For the past few years the recommended amount has been 115,000 skin test doses divided into five portions injected at intervals of a week or so.

Notwithstanding the success of this method of immunization, the rank and file of the medical profession have been slow to practice it. This may be due to the fact that scarlet fever has been mild during the past few years. It is estimated, however, that 50 per cent of the cases of mild involvement are followed by disease of the ear, kidney or heart. Another deterring factor is that the subcutaneous injections recommended are numerous and often attended by unpleasant local and general reactions.

Recently it has been shown by Robinson of West Virginia and by others that about one tenth of the amount of toxin prescribed by the Dicks, if injected into the skin, promises to be as effective as the large amount which is given subcutaneously and that it is unattended by unpleasant local and general reactions. Equally interesting is the probability that the smaller amount may be given in three or perhaps two doses. In my experience I found that 1,600 skin test doses is about the maximum for the first injection, 4,000 for the second and 8,000 to 10,000 for the third. The injections should be spaced two to three weeks apart. They are given on the outer side of the arm above the elbow.

Up to this time I have given 494 intradermal injections in amounts ranging from 50 to 9,000 skin test doses without unpleasant local or general reactions, except in 1 case in which the temperature was 101 F. for one day.

There may be other advantages in the use of scarlatinal toxin. Levison has reported that pooled or individual convalescent scarlet fever serum has been used with benefit in the treatment of diverse streptococcic infections. It seems obvious, therefore, that a person actively immunized against scarlet fever may be less susceptible to other streptococcic infections.

The family physician and the pediatrician should be interested in the technic of intradermal injection, not only for its use against scarlet fever but because of its possible efficacy in the cure and prevention of other diseases.

DISCUSSION

DR. ARTHUR H. PARMELEE: I should like to discuss this paper, largely because I think the pediatricians of Chicago owe a great debt of gratitude to Dr. Earle for his pioneer work with immunization both against scarlet fever and against

diphtheria in the institution in which he has been working. The practical side of immunization against scarlet fever has been brought out clearly by Dr. Earle. It has been my experience, and I think that of all members of the society, that no matter how desirable it is to immunize children against scarlet fever, and even though active immunization has given immunity for a long enough time to be worth while, the practical matter of trying to sell the whole procedure to the family is difficult. It is not easy to obtain patients for a Dick test, then for five doses of toxin and then for another Dick test—which require in all seven visits to the office for a painful injection—especially when the physician must admit that 30 per cent of the children will have marked local and perhaps general reactions.

With the procedure Dr. Earle has suggested and used, three intradermal injections may produce as large a percentage of negative reactions to the Dick test as five subcutaneous injections, and without local or general reactions. This is the sort of thing physicians have been waiting for.

Since a year ago, when Dr. Earle reported this work before the Chicago Medical Society, I have been using this method and have had practically the same experience and results that he has had. Only 1 child showed constitutional symptoms: He had a rather severe reaction with fever after two of the injections. I think that if such a method of intracutaneous injection can be perfected, physicians who wish to immunize patients against scarlet fever will have much less difficulty in convincing them it should be done.

DR. JESSE R. GERSTLEY: Has Dr. Earle had the opportunity of comparing the duration of the immunity established by the intracutaneous method with that of the subcutaneous method? Also, has he had the opportunity of obtaining the opinion of the Dicks on this procedure?

DR. M. L. BLATT: I should like to ask Dr. Earle whether scarlet fever has occurred in the children so immunized, and I should like to ask Dr. Parmelee the same question.

DR. ARCHIBALD L. HOYNE: I know of no one in this section of the country who has had more experience with intracutaneous injection than Dr. Earle.

The observations of my associates and myself in the hospitals are not in agreement with one point I understood Dr. Earle to make. Inoculation for the purpose of preventing scarlet fever has not seemed to lessen other streptococcic infections. In 1936, among 179 student nurses who had negative reactions to the Dick test when they enter the Contagious Disease Hospital, there was only 1 in whom typical scarlet fever developed. However, 64 of the 179 were off duty for two or more days because of streptococcic sore throat. All these had cultures positive for hemolytic streptococci; some had cervical adenitis, a few had otitis media and 1 had mastoiditis, but none had clinical scarlet fever.

There seems to be no doubt that active immunization is of value, particularly in hospitals, but I think it does not insure protection of a person from streptococcic infections.

DR. SAMUEL J. HOFFMAN: I should like to ask Dr. Earle how he deals with patients in whom the reactions to the Dick test are persistently positive after these injections, and how many skin test doses are given to produce a negative reaction. What luck has he had in producing negative reactions in patients whose reactions were stubbornly positive after his routine inoculations?

DR. E. T. MCENERY: I think this paper brings up another subject that is rather important: the immunization of nurses and other personnel in a hospital. My associates and I had the experience that physicians have possibly had in all hospitals: The personnel objected to the Dick immunization because the reaction is severe and the duration of immunity is indefinite. After talking it over with Dr. Hoyne and Dr. Brennemann, we thought it advisable to give intradermal immunization to a group of nurses who had repeatedly had positive reactions to the Dick test. Instead of three, we gave five doses of 0.1 cc. Of the 10 nurses,

8 returned for a Dick test, and only 1 had a positive reaction. I wonder if Dr. Earle has used it for adults.

DR. C. A. EARLE: The time has been too short for one to tell how long the immunity will last. I was rather enthusiastic over my results and mentioned the method to Dr. Gladys Dick. She said that they had tried it years ago and it was not a success.

Scarlet fever has not occurred in any who have received these injections in a little over a year, but some had sore throats after injection. The ages of the children ran from 4 to 13 or 14 years. The retests were given one to three months after immunization.

SURVEY OF SCARLET FEVER, CULTURES FOR HEMOLYTIC STREPTOCOCCI AND DICK TESTS IN A CHILDREN'S HOSPITAL. DR. SILBER PEACOCK, DR. JOHN A. BIGLER and MARIE WERNER, S.B.

The series of papers on this subject constitutes a final report on an extensive investigation initiated by the late Dr. Silber C. Peacock. The work was carried out by him and by Miss Marie Werner throughout 1934 and 1935, and it was completed in the two years following Dr. Peacock's death by Dr. J. A. Bigler and Miss Werner. The investigation was a search for light on the incidence, distribution, specificity and clinical significance of the hemolytic streptococcus and its relation to scarlet fever. A study was made of the personnel of the Children's Hemorial Hospital and of patients both while they were in the hospital and after their discharge. Dr. Peacock had planned to carry on this line of investigation for an indefinite period. The plan was cut short by his tragic and untimely death. He was a keenly meticulous and methodical worker with an uncanny sense and an unending enthusiasm for gathering statistical information. The data that he and Miss Werner had gathered were therefore in such order that they could be accurately formulated and correlated and the work itself could be carried to its present state of completion by Dr. Bigler and Miss Werner. While all the authors shared more or less equally in the undertaking, there was always the sentiment that its presentation should stand as a final tribute to Dr. Peacock from both the Children's Memorial Hospital and the Otho S. A. Sprague Memorial Institute.

I. CULTURES FOR HEMOLYTIC STREPTOCOCCI OF MATERIAL FROM THE NOSES AND THROATS OF HOSPITAL PERSONNEL AND PATIENTS.

SUMMARY

The cultures showed that the incidence of hemolytic streptococci was only moderately higher in the personnel of a children's hospital than in the personnel of a general hospital.

A high percentage of the patients of a children's hospital had positive cultures.

More children had positive cultures after residence in the hospital than when admitted to the hospital.

When material for culture was taken from identical groups of personnel and patients on successive days, the number of positive cultures was about the same for both days, but only 50 to 70 per cent of the persons with positive cultures had positive cultures for both days.

Cultures for adults tended to be more persistently positive than those for children.

The incidence of positive cultures for the personnel was greater during employment in a children's hospital than before such employment.

Nurses on duty in a unit for patients with contagious disease had positive cultures more frequently than those on general duty.

II. Cultures for Hemolytic Streptococci of Material from the Noses and Throats of Patients Admitted to the Hospital.

SUMMARY

The cultures showed that in children the incidence of hemolytic streptococci varied with the seasons but the yearly variation was slight.

For children about to be hospitalized, hemolytic streptococci were cultured in material from the nose alone in 1.5 per cent of the cases, from both the nose and throat in 3 per cent and from the throat alone in 14.5 per cent.

Positive cultures were moderately more frequent for patients with tonsils and adenoids.

Infections of the throat in children did not seem to increase the incidence of positive cultures.

Positive cultures were no more frequent for patients from families with infections of the upper respiratory tract than for patients from families without such infections.

The size of the family bore no relation to the incidence of positive cultures for the patient.

The frequency of positive cultures varied little with the age of the patient, except for a moderate decrease in the case of those under 5 years of age.

Children about to be admitted to the hospital had a lower incidence of positive cultures than patients resident in the hospital.

Positive cultures were more frequent for children than for adults.

III. The Dick Test.

SUMMARY

The reaction to the Dick test was extremely changeable during the first year of life.

Positive reactions to the Dick test were 11 per cent less frequent in children who had had a tonsillectomy.

The Dick reaction changed from positive to negative in 6 per cent more children when a culture of material from the nose and throat was positive for hemolytic streptococci than when it was negative.

In a small number of children (1 per cent) over 2 years of age the Dick reaction changed from negative to positive.

A negative Dick reaction was more apt to be present in the children of larger families than in those of smaller families.

A positive Dick reaction was present in from 13 to 23 per cent of the children who gave a history of having scarlet fever. The figures were even higher for children under 3 years of age who had had scarlet fever.

Scarlet fever may well occur sporadically in hospital patients because of the high incidence of carriers of hemolytic streptococci and positive Dick reactors in both personnel and patients.

IV. Scarlet Fever in a Children's Hospital.

SUMMARY

Sporadic cases of scarlet fever were frequent in a children's hospital.

The number of such cases was thought to have been reduced by isolation of patients, and by removal from patient duty of nurses whose cultures were positive.

Scarlet fever was bound to occur in sporadic cases because of the high incidence of positive cultures for both personnel and patients and because of the high percentage of patients with positive Dick reactions.

In comparatively few of the cases of scarlet fever could exposure be traced to other patients with the disease in the hospital.

In patients known to have been exposed to scarlet fever there was a definite increase in the frequency of positive cultures.

The ideal way to control scarlet fever in a children's hospital would be to require negative Dick reactions in both personnel and patients.

V. Scarlet Fever in Chicago.

SUMMARY

Changing from a three week to a four week period of quarantine for scarlet fever did not control the occurrence of secondary infection. It is questionable whether this change brought about the decreasing frequency of the disease during the period studied.

The seasonal incidence of scarlet fever was similar to, although fluctuating more widely than, the seasonal incidence of cultures positive for hemolytic streptococci.

Of the total cases of scarlet fever in 1934 and 1935, in 20 and in 17.3 per cent, respectively, the disease could be considered as secondary.

The age curve for scarlet fever bore no relation to the age curve for positive Dick reactions until after the sixth year of life.

The length of the period of quarantine had little effect on the incidence of secondary infection.

In approximately 74 per cent of the cases of secondary scarlet fever, the condition resulted from exposure before quarantine was established.

From the number of cases in which secondary scarlet fever occurred during quarantine at home it was evident that adequate quarantine is not enforced.

There was a high incidence of secondary infection which developed from vectors released from the hospital for patients with contagious diseases.

During the period studied there was an average of 1.25 cases of scarlet fever per family in which the disease occurred.

The ideal way to control scarlet fever would seem to be immunization of susceptible persons by some method.

DISCUSSION

Dr. Joseph Brennemann: I have naturally been much interested in this subject, especially as I am in a way medically responsible for contagion in the Children's Memorial Hospital. It is evident that this was an extensive investigation. Dr. Peacock had a genius for collecting, correlating and tabulating material.

The situation with reference to scarlet fever in the hospital, for example, is very different from the situation with, say, measles. Measles spreads by continuity from a child that has the disease to one that is not immune. When there is a patient with scarlet fever in the hospital, a second case rarely occurs as a result of the first because the patient is isolated. In other words, there may be a patient with scarlet fever in one room and a few weeks later one in a pavilion far removed from the first patient, without any known evident contact in the second case. One must therefore assume that there are a number of persons with organisms of scarlet fever in their throats—in other words, carriers. Physicians are not afraid of the child that has scarlet fever with a rash; the thing they fear is the child whose throat appears typical of scarlet fever but who has no rash and who almost certainly can cause another child to have real scarlet fever. All physicians have in practice experienced the fact that if there is a case of scarlet fever in a family the mother or one of the other children will contract the sore throat associated with scarlet fever without a rash. There is still to my mind a great deal of confusion both as to the value of attempts at prophylaxis in cases of scarlet fever and as to the actual cause of the disease. I think that physicians are all getting rather more confused and that it will be some time before the whole matter will be clear in their minds. I believe that the paper just presented adds to the confusion and therefore will be of great value in the eventual settling of the whole matter.

In conclusion I should like to say that I wish I were as convinced that one or, as some one has said, two strains of streptococcus are the specific cause of scarlet fever as I am that the Klebs-Löffler bacillus is the specific cause of diphtheria.

DR. ARCHIBALD HOYNE: Dr. Bigler has presented a remarkable accumulation of material. One could give it an almost unlimited amount of study. It seems to me the primary conclusion that might be drawn from this is the fact that scarlet fever is absolutely uncontrollable at the present time.

The influence of season on scarlet fever is apparent from his figures. It is evident every year. One often wonders why, when about 60 per cent of the patients who leave the hospital have cultures positive for hemolytic streptococci, the hospital is not more crowded. Until some better method is developed for satisfactory quarantine, I see no way of reducing the number of patients with scarlet fever physicians are called to treat year after year. That more patients treated in a hospital seem to have immunity after an attack of scarlet fever than patients treated at home can be explained, perhaps, by their contact with other patients having scarlet fever.

DR. I. HARRISON TUMPEER: The information I give is in answer to Dr. Bigler's question regarding the incidence of hemolytic streptococci in normal children. I quote from an article which Dr. Pilot and I published in the AMERICAN JOURNAL OF DISEASES OF CHILDREN in January 1926 on the incidence of hemolytic streptococci in children under 6 years of age (Bacteriologic Studies of Respiratory Passages; Hemolytic Streptococci in Pharynx and Tonsils of Infants and Children, **31**:*22*). The summary and conclusions were as follows:

Hemolytic streptococci were recovered in large numbers from the excised tonsils of 25 of 28 children (89.3 per cent) aged from 2 to 6 years and from the adenoids of 6 of 11 (55.5 per cent) of the same group.

With swab cultures of material from comparatively normal throats of 75 children aged from 6 weeks to 10 years, hemolytic streptococci were found in sparse numbers in 36 (47.7 per cent).

In young infants and older children, as in adults, these organisms reside normally in the tonsils and adenoids. From these sources the streptococcic complications in the course of other diseases commonly arise.

This work was done in the summer and demonstrates how commonly the hemolytic streptococcus occurs in normal infants and children. Something must occur to the organism to give it the property of producing the disease called scarlet fever. Some children are susceptible to the rash, as the Dick test indicates, and some children are not. The infection must be due to the same organism. As Dr. Brennemann pointed out, every physician has seen in the mother of a patient with scarlet fever the development of soreness of the throat, exudate, cervical adenitis, fever and everything except the rash. The most striking instance of these apparently contradictory phenomena was the case of a child whom Dr. Hess saw with me at the Sarah Morris Hospital. She had been isolated for several weeks with special nurses for an unexplained fever which persisted for several weeks before admission, the temperature rising as high as 102 F. Fulminating scarlet fever developed and terminated fatally in two days.

From the observations we published in 1926, it is evident that the occasion for scarlet fever is present in a large percentage of children even after the age of 6 weeks.

DR. JULIUS HESS: I think the most surprising thing was the high percentage of positive Dick reactions in children who had recently recovered from scarlet fever. Where does that leave one in regard to active immunization with the Dick toxins?

DR. P. L. ARIES: Did you note when reviewing these cases how many patients had scarlet fever more than once?

DR. C. A. EARLE: These observations support an idea that I have had for some time, viz., that the status of a child's immunity to scarlet fever changes with no apparent reason.

DR. JESSE R. GERSTLEY: As there has been so much discussion on the Dick test, I wish to call attention to one fallacy in its interpretation. The discussion has been particularly interesting to me because for many years I have included the immunization to scarlet fever in my pediatric routine. The solution of diphtheria toxoid furnished by the present department of health is rich in peptone. Practically all children met in every day practice have been inoculated with this solution. Whether peptone itself produces an allergic state or whether it enters into some combination with body proteins I do not know, but certainly the patient inoculated with a strong solution of peptone will have a positive reaction to a subsequent intradermal injection of peptone. There is enough peptone in the solution of scarlet fever toxin to produce such a reaction. It is possible that in many patients reactions which are diagnosed as Dick positive are really reactions to peptone. This may account for the many positive reactions which the speaker has reported. It would be well before interpreting the Dick test to inquire from every patient whether he has had injections of diphtheria toxoid furnished by the health department.

DR. JOHN A. BIGLER: In regard to children's having second attacks, there was nothing in the records of the health department that we could use to get such information. We did find in our own records reports on persons who had had second attacks. There is no reason why a second attack should not occur. I think the little reliance that can be placed on a positive culture is important. How many of the cultures will show a strain capable of producing the disease? The present methods of controlling scarlet fever are wholly inadequate, yet it is a disease about which physicians are supposed to know much.

Book Reviews

Diseases of the Blood and Atlas of Hematology. By Roy R. Kracke, M.D., and Hortense E. Garver, M.S. Price, $15. Pp. 530, with 61 illustrations and 29 tables. Philadelphia: J. B. Lippincott Company, 1937.

This book is divided into eight sections. The subjects of these are hematologic terminology, the development and morphology of blood cells, leukocytosis and leukopenia, the anemias, the leukemias, hemorrhagic diseases, miscellaneous diseases and hematologic technic. Thus the entire field of hematology is thoroughly covered. Every condition discussed is illustrated by a colored plate showing the type of cell involved. As these drawings are made from specimens prepared with Wright's stain, they have a universal appeal. An immense amount of material is incorporated in this volume, and the authors have been fair in stating the composite opinion of American and European authorities. The idea of including in one volume both the clinical and the laboratory aspects of study of the blood is excellent. This book should be of great value to any one interested in diseases of the blood.

Diagnostik und Therapie der Kinderkrankheiten. By Prof. Dr. Franz Lust. Ninth edition. Price, 11.50 marks. Pp. 584. Berlin: Urban & Schwarzenberg, 1936.

This book was written primarily to guide practicing physicians in the recognition and intelligent treatment of the diseases of infants and children. The author covers the entire field of pediatrics briefly and clearly, giving special attention to diagnosis and to practical therapeutic measures. A good chapter on growth and development and a concise discussion of foods and food requirements add greatly to the value of the book. The last 125 pages are devoted to the drugs used in pediatric practice; they contain exact advice as to administration and a description of therapeutic procedures, including directions for preparation of food mixtures.

It is not a textbook, but as a reliable book for quick reference it serves a practical purpose. It will be extremely useful from that standpoint to general practitioners and to pediatricians as well.

Die angeborenen Fehlbildungen der menschlichen Hand. By Prof. Walther Müller. Price, 14 marks; cloth, 15.50 marks. Pp. 170, with 116 illustrations. Leipzig: Georg Thieme, 1937.

In this monograph Walther Müller presents a study of the congenital malformations in the human hand. The volume contains more than one hundred excellent roentgenograms and outline drawings, which cover an unusually wide range. In the introduction Professor Müller discusses the various theories of these biologic variations. He divides his subject matter into three chapters: (1) anomalies of the skeletal anlage, (2) malformations on the basis of disturbances of the primitive hand plate and (3) congenital disturbances in the later development of hands.

The book is purely a study of the morphology of excessive, regressive and defective types. The recognized variations are pictured, as well as many little known forms. The monograph does not contain references to clinical or therapeutic measures; however, it will serve as a source book of pathologic patterns in the human hand.

Directory of Pediatric Societies*

INTERNATIONAL

International Association of Preventive Pediatrics

President: Prof. S. Monrad, Dronning Louises Børnehospital, Copenhagen, Denmark.
Secretary: Dr. Daniel Oltramare, 15 Rue Lévrier, Geneva, Switzerland.

International Congress of Pediatrics

President: Prof. Luigi Spolverini, Policlinico Lungo Tevere Melini 24, Rome, Italy.
Secretary: Professor Vitetti, Rome, Italy.
Place: Boston. Time: Sept. 9-12, 1940.
American Committee:
Chairman: Dr. Henry F. Helmholz, Mayo Clinic, Rochester, Minn.
Secretary: Kenneth Blackfan, 300 Longwood Ave., Boston.
Canadian Committee:
Chairman: Dr. Alan Brown, Hospital for Sick Children, 67 College St., Toronto.
Secretary: Dr. H. P. Wright, 1509 Sherbrooke St., W., Montreal.

International Congress for the Protection of Infancy

Secretary: Prof. G. B. Allaria, Corso Bramante 29, Torino 120, Italy.
Place: Frankfort on the Main, Germany. Time: June 12-18, 1938.

FOREIGN

British Paediatric Association

President: Dr. Hector C. Cameron, 23 Devonshire Pl., Upper Wimpole St., London, W. 1, England.
Secretary: Dr. Arthur G. Maitland Jones, 31A Weymouth St., London, W. 1, England.

Danish Pediatric Society

President: Dr. E. Lenstrup, Copenhagen, Denmark.
Secretary: Dr. E. Gjørup, Dronning Louises Børnehospital, Copenhagen, Denmark.

Paediatrický Spolok na Slovensku

President: Dr. Pavel Radosa, Lazaretská 6, Bratislava, Czechoslovakia.
Secretary: Dr. S. Limbacher, Dlhá 2, Bratislava, Czechoslovakia.
Place: Pediatric Clinic, University, Bratislava. Time: Six times a year.

Royal Society of Medicine, Section for the Study of Disease in Children

President: Dr. T. Twistington Higgins, 12 Queen Anne St., London, W. 1, England.
Secretary: Dr. Harold Edwards, 57 Queen Anne St., London, W. 1, England.
Place: 1 Wimpole St., London. Time: Fourth Friday of each month, 4:15 p. m.

Palestine Jewish Medical Association, Section of Physicians of Children's Diseases

President: Prof. S. Rosenbaum, 26 Bialikstr., Tel Aviv, Palestine.
Secretary: Dr. A. Brünn, 9 Maazestre, Tel Aviv, Palestine.

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* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

Sociedad Cubana de Pediatría

President: Dr. Clemente Inclan Costa, Manrique 48, Habana, Cuba.
Secretary: Dr. Serafin Falcon Lopez, Calle B No. 356, Vedado, Habana, Cuba.
Place: Cátedra de Clinica Infantil, Hospital Mercedes, Habana. Time: Last Wednesday of every month.

Société de Pédiatrie de Paris

President: Dr. B. Weill-Hallé, 49 Avenue Raymond Poincaré, Paris.
Secretary: Dr. Jean Hallé, 10 bis Rue du Pré aux Clercs, Paris.
Place: Hôpital des Enfants Malades, 49 Rue de Sèvres, Paris. Time: 4:30 p. m., third Thursday of every month.

NATIONAL

American Medical Association, Scientific Assembly, Section on Pediatrics

Chairman: Dr. Edward Clay Mitchell, 1073 Madison Ave., Memphis, Tenn.
Secretary: Dr. Albert D. Kaiser, 16 N. Goodman St., Rochester, N. Y.
Place: St. Louis.

American Academy of Pediatrics

President: Dr. Philip Van Ingen, 125 E. 71st St., New York.
Secretary: Dr. C. G. Grulee, 636 Church St., Evanston, Ill.
Region I. Place: Hotel Seneca, Rochester, N. Y. Time: Nov. 11-12, 1938.
Region II. Place: Skirven Hotel, Oklahoma City. Time: Nov. 16, 1938.
Region III. Place: Statler Hotel, Detroit, Mich., and Ann Arbor, Mich. Time: Oct. 27-29, 1938.

American Hospital Association, Children's Hospital Section

Chairman: Miss Mabel Binner, Children's Memorial Hospital, Chicago.
Secretary: Winifred Culbertson, Children's Convalescent Hospital, Cincinnati.

American Pediatric Society

President: Dr. Clifford G. Grulee, 636 Church St., Evanston, Ill.
Secretary-Treasurer: Dr. Hugh McCulloch, 325 N. Euclid St., St. Louis.
Place: Skytop Lodge, Skytop, Pa. Time: April 27-29, 1939.

Canadian Society for the Study of Diseases of Children

President: Dr. Alton Goldbloom, 1543 Crescent St., Montreal, Quebec.
Secretary-Treasurer: Dr. Pearl Summerfeldt, Hospital for Sick Children, Toronto, Ont.

Society for Pediatric Research

President: Dr. Samuel Z. Levine, 525 E. 68th St., New York.
Secretary: Dr. A. A. Weech, 3975 Broadway, New York.

SECTIONAL

North Pacific Pediatric Society

President: Frederick Fischer, 407 Riverside Ave., Spokane, Wash.
Secretary: Dr. C. L. Lyons, Paulsen Medical-Dental Bldg., Spokane, Wash.

Southern Medical Association, Section of Pediatrics

Chairman: Dr. Charles E. Conrad, 209-210 Professional Bldg., Harrisburg, Va.
Secretary: Dr. Hughes Kennedy Jr., Highland Plaza Apts., Birmingham, Ala.
Place: Oklahoma City. Time: Nov. 15-18, 1938.

STATE

Alabama Pediatric Society

President: Dr. Stewart H. Welch, 1117 S. 20th St., Birmingham.
Secretary-Treasurer: Dr. William R. Britton, 4 Catoma St., Montgomery.
Place: Montgomery. Time: April 17, 1939.

Arkansas State Pediatric Association

Chairman: Dr. E. C. McMullen, 500 Main St., Pine Bluff.
Secretary: Dr. Madeline M. Melson, 909 Main St., Little Rock.

California State Medical Society, Section on Pediatrics

Chairman: Dr. E. Earl Moody, 3780 Wilshire Blvd., Los Angeles.
Secretary: Dr. Hartzel H. Ray, 23–2d Ave., San Mateo.

Florida State Pediatric Society

President: Dr. Douglas D. Martin, 442 W. Lafayette St., Tampa.
Secretary: Dr. Warren W. Quillian, 227 Avenue Aragon, Coral Gables.
Place: Concurrent with state association meeting at time of convention.

Georgia Pediatric Society

President: Dr. Roger W. Dickson, 33 Ponce de Leon Ave., N. E., Atlanta.
Secretary-Treasurer: Dr. Don F. Cathcart, 478 Peachtree St., N. E., Atlanta.

Hezekiah Beardsley Pediatric Club of Connecticut

President: Dr. J. Harold Root, 103 N. Main St., Waterbury.
Secretary: Dr. Joseph L. Hetzel, 103 N. Main St., Waterbury.
Time: Three meetings a year.

Indiana State Pediatric Society

President: Dr. O. N. Torian, 23 E. Ohio St., Indianapolis.
Secretary-Treasurer: Dr. Mathew Winters, 621 Hume Mansur Bldg., Indianapolis.
Time: Two meetings a year.

Iowa Pediatric Society

President: Dr. Morgan J. Foster, 837 Higley Bldg., Cedar Rapids.
Secretary-Treasurer: Dr. Arnold M. Smythe, 406–6th Ave., Des Moines.

Louisiana State Pediatric Society

President: Dr. Ruth Aleman, 1407 S. Carrollton Ave., New Orleans.
Secretary-Treasurer: Dr. Philip C. de Verges, 312 Audubon Bldg., New Orleans.

Medical Society of State of New York, Section on Pediatrics

Chairman: Dr. Paul W. Beaven, 26 S. Goodman St., Rochester.
Secretary: Dr. Leslie O. Ashton, 842 Park Ave., New York.

Medical Society of the State of Pennsylvania, Pediatric Section

Chairman: Dr. John P. Scott, 1740 Bainbridge St., Philadelphia.
Secretary: Dr. John M. Higgins, 600 S. Wilbur Ave., Sayre.

Michigan State Medical Society, Pediatric Section

Chairman: Dr. Allan L. Richardson, 3001 W. Grand Blvd., Detroit.
Secretary: Dr. Ward L. Chadwick, 524 Medical Arts Bldg., Grand Rapids.
Place: Detroit. Time: Sept. 20-22, 1938.

Mississippi State Pediatric Society

President: Dr. Guy C. Jarratt, 920 Crawford St., Vicksburg.
Secretary-Treasurer: Dr. Harvey F. Garrison Jr., 315 E. Capitol Pl., Jackson.
Place: To be designated by Society. Time: Yearly.

Nebraska Pediatric Society

President: Dr. J. A. Henske, 1614 Medical Arts Bldg., Omaha.
Secretary-Treasurer: Dr. J. H. Murphy, 915 Medical Arts Bldg., Omaha.
Place: As announced by committee. Time: Third Thursday of each month from October to June, inclusive. Dinner at 6 p. m.

North Carolina Pediatric Society

President: Dr. John LaBruce Ward, Arcade Bldg., Asheville.
Secretary: Dr. Lewis Elias, 36 Grove St., Asheville.

Oklahoma State Pediatric Society

President: Dr. A. L. Salomon, 1200 N. Walker St., Oklahoma City.
Secretary: Dr. Ben H. Nicholson, 301 W. 12th St., Oklahoma City.

South Carolina Pediatric Society

President: Dr. Mylnor W. Beach, 126 Meeting St., Charleston.
Secretary-Treasurer: Dr. D. Lesesne Smith Jr., 187 Oakland Ave., Spartanburg.

Tennessee State Pediatric Society

President: Dr. William E. Van Order, 546 McCallie Ave., Chattanooga.
Secretary: Dr. Kinsey M. Buck, 1193 Madison Ave., Memphis.
Place: Jackson. Time: April 11, 1939.

Texas Pediatric Society

President: Dr. F. O. Calaway, 3306 Fannin St., Houston.
Secretary-Treasurer: Dr. F. H. Lancaster, 4409 Fannin St., Houston.
Place: Houston. Time: May 9, 1939.

Virginia Pediatric Society

President: Dr. W. Ambrose McGee, 616 W. Grace St., Richmond.
Secretary: Dr. John M. Bishop, Medical Arts Bldg., Roanoke.
Place: Danville, Va. Time: October 1938.

West Virginia State Medical Society, Section on Pediatrics

President: Dr. Claude L. Holland, 400 Locust Ave., Fairmont.
Secretary: Dr. Theresa O. Snaith, Weston.

LOCAL

Academy of Medicine of Cleveland, Pediatric Section

Chairman: Dr. N. C. Wetzel, 2103 Adelbert Rd., Cleveland.
Secretary: Dr. Fred Rittenger, 10515 Carnegie Ave., Cleveland.
Place: Cleveland Medical Library Bldg. Time: October, December, February and April.

Academy of Medicine, Toronto, Section of Pediatrics

President: Dr. T. B. Verner, 170 St. George St., Toronto.
Secretary: Dr. D. V. Hutton, 170 St. George St., Toronto.

Bronx Pediatric Society

President: Dr. Samuel Tripler, 1555 Grand Concourse, New York.
Secretary: Dr. Harry S. Altman, 940 Grand Concourse, New York.
Place: Concourse Plaza Hotel, 161st St. and Grand Concourse. Time: Every second Wednesday of each month, except June, July, August and September.

Brooklyn Academy of Pediatrics

President: Dr. Walter D. Ludlum, 1421 Cortelyou Rd., Brooklyn.
Secretary: Dr. John A. Monfort, 861 Carroll St., Brooklyn.
Place: Kings County Medical Society Bldg. Time: Fourth Wednesday of each month, except May, June, July, August and September.

Central New York Pediatric Club

President: Dr. Frank Vasder Bogert, 111 Union St., Schenectady.
Secretary: Dr. Frank J. Williams, 58 S. Swan St., Albany.
Place: Various cities in New York. Time: Third Thursday of April and September.

Chicago Pediatric Society

President: Dr. C. A. Aldrich, 723 Elm St., Winnetka, Ill.
Secretary: Dr. George F. Munns, 723 Elm St., Winnetka, Ill.
Place: Children's Memorial Hospital, 710 Fullerton Ave., Chicago. Time: Third Tuesday of each month, October to May, inclusive.

Dallas Pediatric Society

President: Dr. W. H. Bradford, 1719 Pacific Ave., Dallas, Texas.
Secretary-Treasurer: Dr. John E. Ashby, 3622 Fairmont Ave., Dallas, Texas.
Place: Bradford Baby Hospital. Time: 1 p. m., second and fourth Saturdays of each month.

Detroit Pediatric Society

President: Dr. William O'Donnell, 1553 Woodward Ave., Detroit.
Secretary: Dr. Robert Mason, 5140 Second Blvd., Detroit.
Place: Wayne County Medical Society. Time: 8:30 p. m., first Wednesday of each month from October to June, inclusive.

Fulton County Medical Society, Pediatric Section (Atlanta, Ga.)

Chairman: Dr. L. H. Goldsmith, 384 Peachtree St., N. E., Atlanta.
Secretary: Dr. James P. Hanner, 384 Peachtree St., N. E., Atlanta.
Place: Academy of Medicine, 38 Prescott St., N. E. Time: Second Thursday of each month from October to April, 8 p. m.

Houston Pediatric Society

President: Dr. Walter F. Qualtrough, 920 Westheimer Ave., Houston, Texas.
Secretary-Treasurer: Dr. Allan Penny Bloxsom, 4402 Travis St., Houston, Texas.
Place: Houston Club. Time: Third Monday of each month.

Intermountain Pediatric Society

President: Dr. Eugene Smith, 385–24th St., Ogden, Utah.
Secretary-Treasurer: Dr. W. C. Cheney, 1020 Boston Bldg., Salt Lake City, Utah.
Place: Salt Lake City General Hospital. Time: First Thursday of each month, 8 p. m.

Kansas City (Missouri) Pediatric Society

President: Dr. W. R. Moore, 620 Francis St., St. Joseph, Mo.
Secretary: Dr. F. S. Hogue, 1103 Grand Ave., Kansas City, Mo.
Place: Kansas City General Hospital. Time: On call.

Los Angeles County Medical Association, Pediatric Section

President: Dr. Edwin F. Patton, 3875 Wilshire Blvd., Los Angeles.
Secretary-Treasurer: Dr. Henry F. Gallagher, 1930 Wilshire Blvd., Los Angeles.
Place: Los Angeles County Medical Headquarters, 1925 Wilshire Blvd.
Time: Second Monday of February, April, June, October and December.

MEDICAL SOCIETY OF THE COUNTY OF KINGS AND THE ACADEMY OF MEDICINE OF BROOKLYN, PEDIATRIC SECTION

President: Dr. Sidney D. Kramer, 61 Eastern Parkway, Brooklyn.
Secretary: Dr. Benjamin Stoloff, 1149 Eastern Parkway, Brooklyn.
Place: 1313 Bedford Ave., Brooklyn. Time: Third Wednesday of each month, October to May.

MEDICAL SOCIETY OF THE COUNTY OF QUEENS, INC., SECTION ON PEDIATRICS

Chairman: Dr. James Dobbins, 42-04 Ditmars Blvd., Long Island City, N. Y.
Secretary-Treasurer: Dr. Edith A. Mittell, 144–38th Ave., Flushing, N. Y.
Place: Queens County Medical Bldg., Forest Hills, N. Y. Time: Third Monday of October, January, March and May.

MEMPHIS PEDIATRIC SOCIETY

President: Dr. Barton Etter, 376 S. Bellevue St., Memphis, Tenn.
Secretary-Treasurer: Dr. Harry Jacobson, 1193 Madison Ave., Memphis, Tenn.
Place: John Gaston Hospital. Time: Quarterly.

MILWAUKEE PEDIATRIC SOCIETY

President: Dr. Joseph Shimpa, 2309 N. 36th St., Milwaukee.
Secretary: Dr. Helen Jane Zillmer, 781 N. Jefferson St., Milwaukee.
Place: Children's Hospital. Time: Second Wednesday of each alternate month, beginning with February.

NEW ENGLAND PEDIATRIC SOCIETY

President: Dr. Henry E. Utter, 122 Waterman St., Providence, R. I.
Secretary-Treasurer: Dr. Henry E. Gallup, 1101 Beacon St., Brookline, Mass.
Place: Boston Medical Library. Time: Four meetings a year, occurring from September to May.

NEW YORK ACADEMY OF MEDICINE, SECTION OF PEDIATRICS

Chairman: Dr. Philip M. Stimson, 25 Claremont Ave., New York.
Secretary: Dr. Lucy Porter Sutton, 168 E. 74th St., New York.
Place: New York Academy of Medicine, 2 E. 103d St. Time: Second Thursday of each month from October to May, inclusive, 8:30 p. m.

NORTHWESTERN PEDIATRIC SOCIETY

President: Dr. Roger L. J. Kennedy, Mayo Clinic, Rochester, Minn.
Secretary-Treasurer: Dr. Robert Rosenthal, 437 Lowry Medical Arts Bldg., St. Paul.
Place: Minneapolis, St. Paul, Duluth and Rochester. Time: January, April, July and October.

OKLAHOMA CITY PEDIATRIC SOCIETY

President: Dr. A. L. Salomon, 1200 N. Walker St., Oklahoma City.
Secretary: Dr. G. R. Felts, 1200 N. Walker St., Oklahoma City.
Time: Every month, except June, July and August.

PHILADELPHIA PEDIATRIC SOCIETY

President: Dr. Julian M. Lyon, 40 Llanfair Rd., Ardmore, Pa.
Secretary: Dr. Aims C. McGuinness, Children's Hospital, 1740 Bainbridge St., Philadelphia.
Place: College of Physicians, 19 S. 22d St. Time: Second Tuesday of each month from October to April, inclusive.

PITTSBURGH PEDIATRIC SOCIETY

President: Dr. James LeRoy Foster, Highland Bldg., Pittsburgh.
Secretary-Treasurer: Dr. E. R. McClusky, 3200–5th Ave., Pittsburgh.
Place: Pittsburgh Academy of Medicine. Time: Second Friday, alternate months from October to June, inclusive.

Richmond Pediatric Society

President: Dr. A. S. Hurt, 1028 W. Franklin St., Richmond, Va.
Secretary-Treasurer: Dr. Louise Fry Galvin, 2416 Stuart Ave., Richmond, Va.
Place: Richmond Academy of Medicine, 1200 E. Clay St. Time: First Thursday of each month (except July, August and September).

Rochester Pediatric Society

President: Dr. J. Merrel Parker, 11 N. Goodman St., Rochester, N. Y.
Secretary: Dr. H. C. Soule, 16 N. Goodman St., Rochester, N. Y.
Place: Arranged by program committee. Time: Second Friday of each month.

Rocky Mountain Pediatric Society

President: Dr. John Schoonover, Republic Bldg., Denver.
Secretary: Dr. F. Craig Johnson, 1850 Gilpin St., Denver.
Place: Children's Hospital, Denver. Time: First Saturday of each month from September to May, inclusive, 7:30 p. m.

St. Louis Pediatric Society

President: Dr. John Zahorsky, 536 N. Taylor Ave., St. Louis.
Secretary-Treasurer: Dr. Max Deutch, 634 N. Grand Blvd., St. Louis.
Place: St. Louis Medical Society. Time: Third Friday of every month.

Seattle Pediatric Society

President: Dr. Frank H. Douglass, Medical Dental Bldg., Seattle.
Secretary: Dr. C. Luverne Smith, Stimson Bldg., Seattle.
Place: College Club. Time: Third Friday of each month, 6:30 p. m.

Southwestern Pediatric Society

President: Dr. Philip E. Rothman, 3875 Wilshire Blvd., Los Angeles.
Secretary: Dr. Norman Nixon, 1136 W. 6th St., Los Angeles.
Place: University Club of Los Angeles. Time: First Wednesday in January, March, May, September and November.

University of Michigan Pediatric and Infectious Disease Society

President: Dr. Damon O. Walthall, 1103 Grand Ave., Kansas City, Mo.
Secretary: Dr. D. Murray Cowie, University of Michigan, Ann Arbor, Mich.

Westchester County Medical Society, Pediatric Section (New York)

President: Dr. R. A. Higgons, 264 King St., Port Chester, N. Y.
Secretary-Treasurer: Dr. Elvira Ostlund, 131 Purchase St., Rye, N. Y.
Place: Grasslands Hospital, Valhalla, N. Y. Time: Third Thursday in October, December, February and April.